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Water Conservation, Energy Efficiency, and Solar Power Project

2014 WaterSMART Water and Energy Efficiency Grant Application

FOA No. R14AS00001

Rosedale-Rio Bravo Water Storage District
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1.1 Executive Summary

Applicant Information:

January 17, 2014

Rosedale-Rio Bravo Water Storage District
Bakersfield
Kern County
California

Dan Bartel – Project Manager
Zach Smith – Technical Contributor

The Water Conservation, Energy Conservation, and Solar Power Project is designed to improve overall District system efficiency in two basic ways by saving precious water supplies and reducing energy usage. This will be accomplished by five strategic District projects:

1. West Intake Canal Liner – Canal seepage reduction
2. Onyx Control Structure Meter and Flow Control Retrofits – Spill reduction
3. Variable Frequency Drive Units – Improved energy use efficiency
4. Solar Well Pumping Units – Energy generation and use efficiency
5. On-Farm Irrigation Improvements - If NRCS funds are available, the District will facilitate a cost-share grant program with Natural Resource Conservation and District water-users to incentivize investments in on-farm irrigation systems.

The conserved water as a direct result of the Project will provide additional water to:

1. District water-users for agricultural, municipal, and industrial uses.
2. In-stream flows for wildlife enhancement.
3. Reduce groundwater pumping.
4. 3rd party banking and transfer partners.

This Project meets ALL of the Objectives of Section I.B and all of the Tasks of Section III.B. of the Funding Opportunity Announcement No. R14AS00001 by leveraging RRBWSD money and resources by cost sharing with Reclamation and potential the NRCS by developing projects that conserve water and energy by improving water management, creating new supplies for agricultural, municipal, and industrial users, and wildlife (including endangered species) enhancement, reducing groundwater pumping, generating of solar energy, and reducing energy use through employing high efficiency technologies.

Average annual water supply	125,000 AFY
Estimated water saved after the project is completed	2,867 AFY
Estimated amount of water better managed	44,000 AFY
Estimated energy generated or conserved	285,500 kWh/Yr

It is expected that this program will proceed immediately upon notification of grant funding and would be completed by May 31, 2015.

Table 1. Funding Chart.

Funding Source	Funding Amount
Non-Federal Entities	
Rosedale-Rio Bravo Water Storage District	$207,000
Rosedale-Rio Bravo Water Storage District (in-kind)	$199,573
Non-Federal Subtotal	**$406,573**
Requested Reclamation Funding	**$300,000**
Total Project Funding	**$706,573**

1.2 Background Data

Rosedale-Rio Bravo Water Storage District (RRBWSD) is located in the southern San Joaquin Valley, immediately west of the City of Bakersfield, and has a gross area of approximately 44,000 acres (Figures 1. & 2.). The District lands are located within the Kern River Alluvial Fan where historic runoff created an efficient aquifer system from which the District recharges groundwater into so as to support groundwater pumping for agricultural, municipal, and industrial uses. The District is an independent special district, organized on August 27, 1958, under the provisions of the California Water Storage District Law (Division 14 of the Water Code of the State of California) (the "Act"). The District's boundaries encompass a portion of the City of Bakersfield. The property within the Storage District is agricultural, municipal and industrial. Of the total 44,000 acres, approximately 27,000 acres are currently in crops (forage, nuts, dairy, almonds, pistachios, vegetables, etc.). See Appendix A for 2010 RRBWSD Crop Survey. The balance is a mix of open ground, rural development (0.25-10 acre lots), and light industrial businesses that mainly support the agricultural and petroleum industries. These uses are served potable water by both individual and mutual domestic water wells.

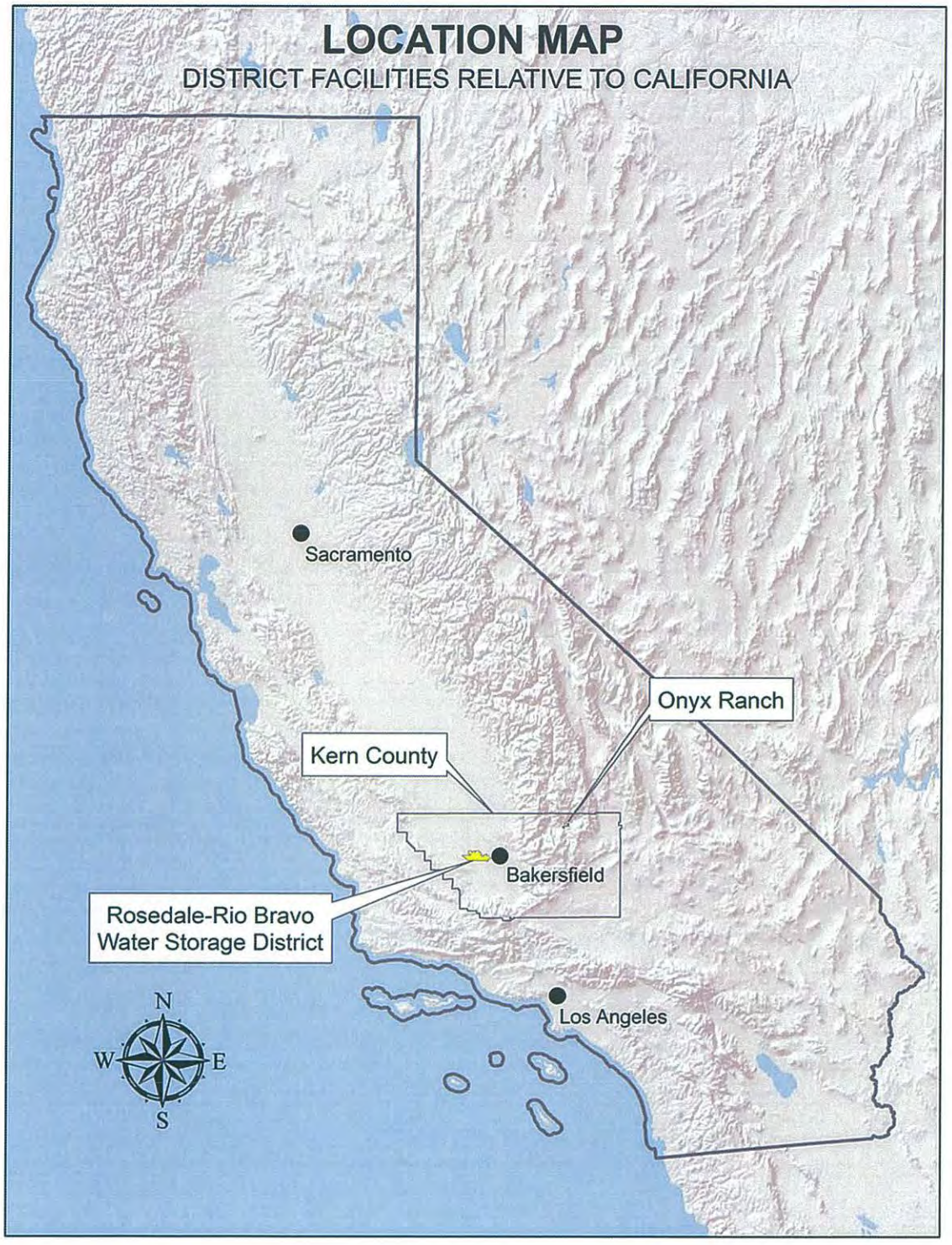


Figure 1. Project Location

In 1959 the voters within the District approved a general project, consisting of the construction of recharge basins and water conveyance facilities capable of capturing water supplies and percolating those supplies into the underground aquifer for replenishment of water pumped by landowners within the District (the "Recharge Project"). The construction of the initial phases of the Recharge Project was completed in 1962. Additional improvements to the Recharge Project have been made and additional facilities and properties have been added since the original project was completed. Subsequent to the completion of construction of the Recharge Project, the District acquired a State Water Project (SWP) water supply through the Kern County Water Agency (the "Agency"). RRBWSD has also been a historic user of surplus Friant-Kern Canal flows and a user of Kern River water via its contract with the Kern County Land Company (now City of Bakersfield) to serve irrigation demands and for groundwater recharge programs.

The District operates a water delivery system consisting of 25 miles earthen canals, 2 mile pipelines, check structures, pipelines, and wells all designed for the primary function of groundwater banking and conjunctive use (recharge and recovery). There are approximately 20 connections to landowner irrigation systems that are used for in-lieu groundwater recharge purposes. The District acquires wet-year supplies via various contracts and banking programs which require that a portion of the supplies are returned in dry years. Conveyance systems for banking return are a mix of pipelines and earthen canals, thus water evaporation and seepage reduces the project's return capabilities. The District and its landowners are served by the Pacific Gas and Electric Company; the vast majority of energy used for groundwater recovery and conveyance is electrical based.

The District has developed and enjoys partnerships with many different state, federal, and local entities to help improve water management and meet future water demand needs. Currently and historically RRBWSD has worked with the U.S. Department of the Interior, Bureau of Reclamation (USBR) and Fish and Wildlife Service to provide water to the Kern National Wildlife Refuge (KNWR) to the northwest of the District and to obtain water from the Central Valley Project. RRBWSD also partners with multiple Federal Friant-Kern water agencies for mutually beneficial recharge and recovery projects, namely: Arvin-Edison WSD, Kern-Tulare WD, and Delano ID. Below is a list of the various contracts involving RRBWSD and Federal agencies:

KNWR Purchase & Conveyance Agreements
- Year 2007

CVP Short-Term/Temporary Water Service Contracts (non-CVP Contractor)
- Year 1965, No. 14-06-200-769A
- Year 1973, No. 14-06-200-4032
- Year 1973, No. 14-06-200-229A
- Year 1973, No. 14-06-200-7228A
- Year 1973, No. 14-06-200-4162A
- Year 1978, No. 14-06-200-229A
- Year 1993, No. 3-07-20-W1058

Year 1995, No. 5-07-20-W12
Year 2001, No. 01-WC-20
Year 2003, No. 03-WC-20-2654
Year 2011, No. 11-WC-20-0090
Year 2011, No. 11-WC20-0104

Federal Exchange and Banking Agreements
Arvin-Edison WSD, 1997, 2003, 2009, 2011, 2012, 2013
Delano ID, 2009
Kern-Tulare WD, 2001, 2004, 2005, 2007

The District recently acquired approximately 3,400 acres of land, known as the Onyx Ranch, in the South Fork Valley of the Kern River. It is located approximately five miles east of Lake Isabella and 50 miles east of Bakersfield. The Onyx Ranch has a long and rich history in the South Fork Valley beginning with William Scodie when he began irrigating the ranch in 1861. The 3,400 acre property is an amazing combination of rocky terrain, riparian habitat, irrigated pastures and meadows, and irrigated farm fields. There are ditches, barns, stables, ranch houses, and even the historic Onyx Store. The District contracts with the state of California for a water supply from the Sacramento/San Joaquin Delta ("Delta"). While it pays for 100% of the water contracted, nearly $3 million per year, we receive on average only 60% of the water. In an effort to ensure stable sources of water supply due to environmental, climatic, and legal restrictions in the Delta, the District is looking to develop a series of projects intended to acquire additional water at a reduced overall cost. One project is the purchase of the Onyx Ranch east of Lake Isabella in order to acquire certain water rights associated with the property. Currently the District is working on maintaining and improving the existing ranch operations which are in need of modernization. Agricultural leases have been executed with experienced local operators in order to maximize benefits to the local economy.

RRBWSD also has a partnership with the State of California, Department of Fish and Wildlife, Audubon, and Desert Mountain Resource Conservation and Development Council in the Sierra Nevada Conservancy Noxious Weed Treatment Project in order to protect critical habitat in the South Fork Valley for the benefit of endangered species.

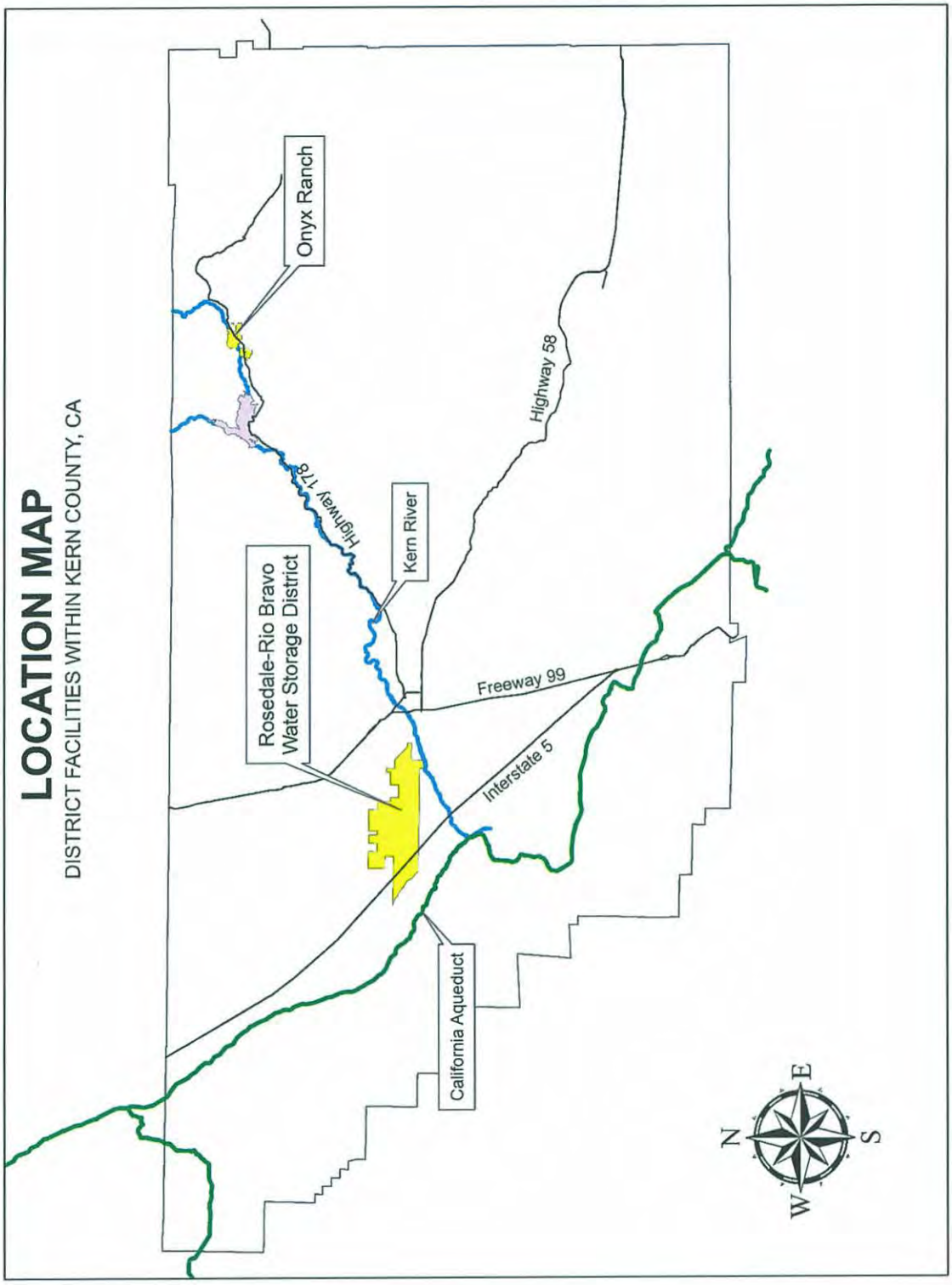


Figure 2. Component Locations

1.3 Technical Project Description

The District's Water Conservation, Energy Efficiency, and Solar Power Project is designed to improve overall District system efficiency in two basic ways by saving precious water supplies and reducing energy usage. This will be accomplished by five strategic District projects:

1. West Intake Canal Liner – Canal seepage reduction
2. Onyx Control Structure Meter and Flow Retrofits – Over delivery/spill reduction
3. Variable Frequency Drive Units – Improved energy use efficiency
4. Solar Well Pumping Units – Energy generation and use efficiency
5. On-Farm Irrigation Improvements - If NRCS funds are available, the District will facilitate a cost-share grant program with Natural Resource Conservation and District water-users to incentivize investments in on-farm irrigation systems.

The conserved water as a direct result of the Project will provide additional water to:

1. District water-users via groundwater recharge for agricultural, municipal, and industrial uses.
2. In-stream flows for wildlife enhancement.
3. Reduce groundwater pumping.
4. Increase supply to 3rd party banking and transfer partners.

This Project meets ALL of the Objectives of Section I.B and all Tasks of Section III.B. of the Funding Opportunity Announcement No. R14AS00001 by leveraging RRBWSD money and resources by cost sharing with Reclamation by developing projects that reduce energy consumption, save water, improve water management, create new supplies for agricultural, municipal, industrial and wildlife enhancement, reduce groundwater pumping and thus improving energy efficiency, and benefit to endangered species by improved conveyance facilities that will increase in-stream flows.

For project management, RRBWSD is taking a 5 step approach to handle the major tasks associated with the project:

1. **Feasibility Study** – RRBWSD technical staff and consultants, have evaluated the feasibility of the projects as shown on the Project Summary Matrix and Water Management Program Score and B/C ratios in Appendix B and in reports and technical memos in Appendix D-G. The evaluation includes considering issues such as water system delivery effectiveness, construction reasonableness, environmental impacts and cost/benefit ratios.

2. **Environmental and Regulatory** – RRBWSD will take the necessary measures to satisfy federal and state environmental requirements and regulations. Using the environmental information obtained from various studies, required steps will be taken to meet CEQA and/or NEPA compliance and all necessary permit applications will be submitted. Please see the following sections 2.0 and 3.0.

3. **Design -** This task includes the preliminary and final designs of the facilities.

4. **Installation** – This task includes procurement of materials, contractor bidding and selection (if necessary), and actual construction.

5. **Inspection and Testing** – Upon completion of construction a detailed inspection will occur, equipment training, testing and calibration, as well as a performance evaluation will be followed by a final report to provide an account of project progression and expenditures. Also, any state and federal required project completion reports will be provided to the respective agencies. Ongoing monitoring of project performance and evaluation will be conducted to determine actual water conservation and energy benefits.

As with most major projects, many aspects or details from each of the listed steps require parallel progression and overlap is necessary to produce an efficient project schedule. It is estimated that the Project will be completed in approximately 24 months. Please see Appendix C for a preliminary project schedule.

This project consists of the following specific components:

1. **West Intake Canal Lining** – RRBWSD currently delivers water almost annually via its West Intake Canal to and from its groundwater banking and recovery project and the Cross Valley Canal, Friant-Kern Canal, and the California Aqueduct. It is a two mile canal, one mile is concrete lined and the other earthen in a very sandy area. By installing a poly liner in a one mile section, as shown in Appendix D, system conveyance losses will be reduced which will reduce groundwater pumping, effectively provide more dry-year supply, and reduce energy consumption. See Figure 3. for component location.

2. **Onyx Control Structure Meter and Flow Retrofits** – RRBWSD delivers Kern River water to its lands at Onyx Ranch and additional flows to adjacent landowners. Upon acquisition of the property the District has evaluated the existing control and metering infrastructure and desires to make improvements that will improve system operations and reduce system spills, thus returning water to in-stream flows on the South Fork of the Kern River. This will also aid the District and other water-users in compliance with new State Water Resources Control Board and California state law water measurement requirements. This project involves retrofitting of up to nine control structures with a combination of sluice gates and doppler/acoustic flow metering devices. By making the recommended improvements as shown in Appendix E, system over diversion and spillage could be reduced and returned to in-stream flows, transferred, or recharged to the groundwater basin. On-farm irrigation efficiencies may also see improvement from improved system measurement and control. See Figure 4. for component locations

3. **Variable Frequency Drive Units** – RRBWSD has identified the potential benefit of retrofitting three existing wells (300 HP each) and one existing pumping plant (150 HP) with variable frequency drives (VFD's). See Appendices E and F for technical details.

   Wells - The three wells are located within the Enns groundwater recharge area which experiences static depths to groundwater which vary from as much as 20-250 feet below ground surface as such the pumping efficiencies vary greatly (68-83%) because of the wide range of operating conditions. These wells were designed as high capacity banking return wells but are also made available to adjacent growers to meet cropping demands. The designed flows are often in excess of the irrigation system capacities thus requiring manually back-pressuring the wells with control valves to reduce flow which needlessly burns valuable head. With the incorporation of VFD's the District would reduce energy usage. See Appendix F for technical details and Figure 3. for component location.

   Pump - The Mack Pumping Plant, located at the Onyx Ranch, lifts water 30 feet from the Nicoll Ditch up to the Mack Ditch. There are two vertical turbine, single stage pumps, each 150 HP. Each is capable of producing about 26 cfs, for a total of 52 cfs. Most of the time the irrigation demand is not in 26 cfs increments therefore as much as 17% of the produced flow is simply spilled back into the river or into lower meadows after being pumped. With the incorporation of a VFD the District would reduce energy usage and reduce unnecessary over-diversion. See Appendix E for technical details and Figure 4. for component location.

4. **Solar Well Pumping Units** – RRBWSD contracts with local ranchers to both maintain its groundwater recharge ponds and the Onyx Ranch. At times there is insufficient surface water for stock water purposes therefore the ranchers access large irrigation wells to fill water troughs or even truck water from off-site. By installing three solar powered pumping units in active irrigation wells these costs and inefficient energy usage can be avoided altogether. See Appendix G for technical details and Figure 4. for component locations.

5. **On-Farm Irrigation Improvements** – In addition to chronic water supply shortages from the State Water Project, which is a supplemental source for the local groundwater basin, Growing waste discharge regulations instituted by the Regional Water Quality Control Board – Central Valley is driving the District growers towards considering additional irrigation systems improvements in order to reduce over-irrigation and the leaching of nutrients and pesticides to groundwater. To that end the District will cooperate with the Natural Resources Conservation Service (NRCS) to facilitate on-farm cost-share programs and projects that will better manage irrigation water and reduce deep percolation. The District would produce and send out information packages, add information to its website, and

host meetings with the landowners. Program goals and objectives will be jointly developed with the NRCS and RRBWSD. Once these goals and objectives are finalized the NRCS will evaluate and facilitate cost-share agreements with the water-users and ensure that the proposed on-farm improvements are consistent with the goals and objectives.

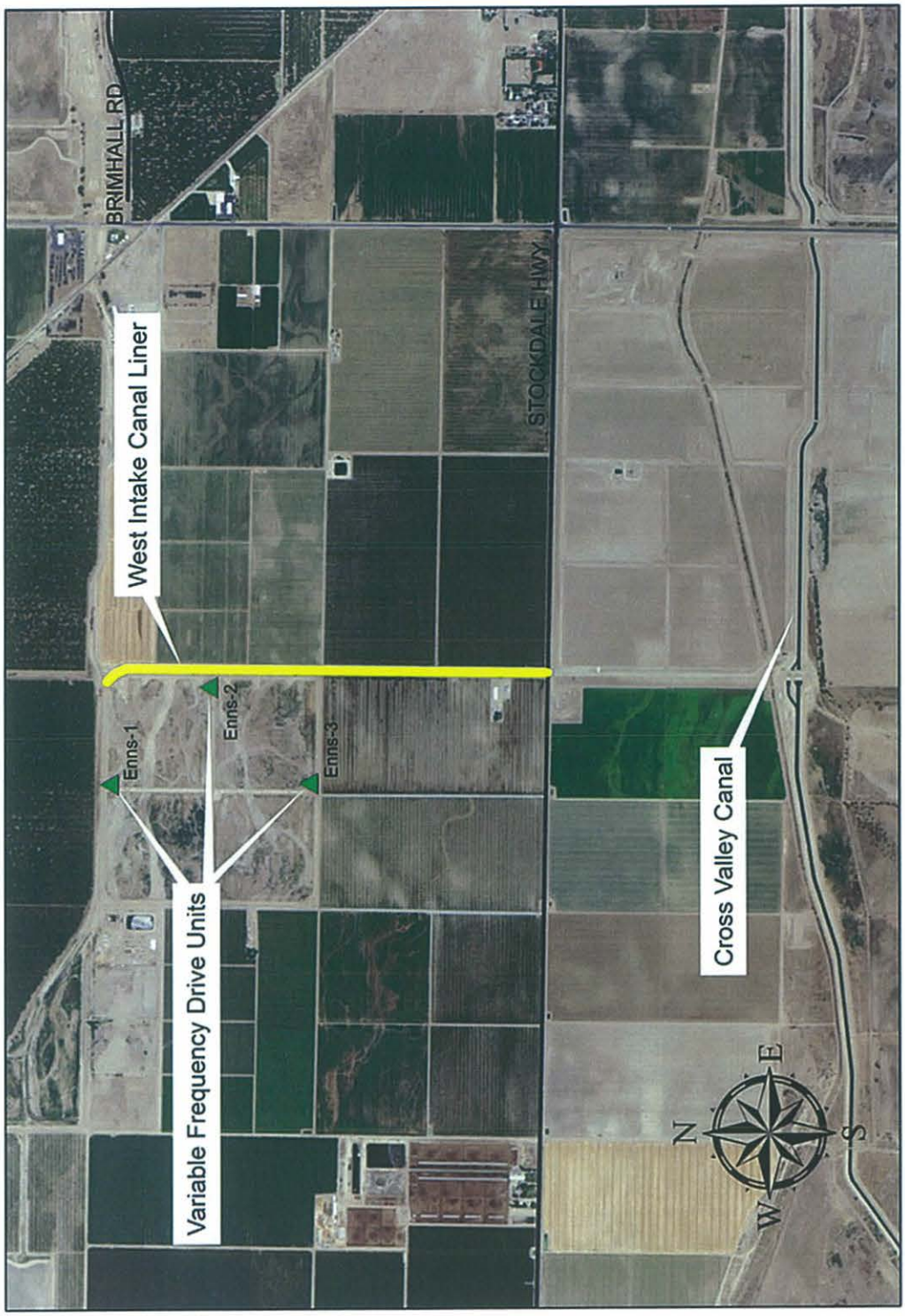


Figure 3. District Project Component Locations

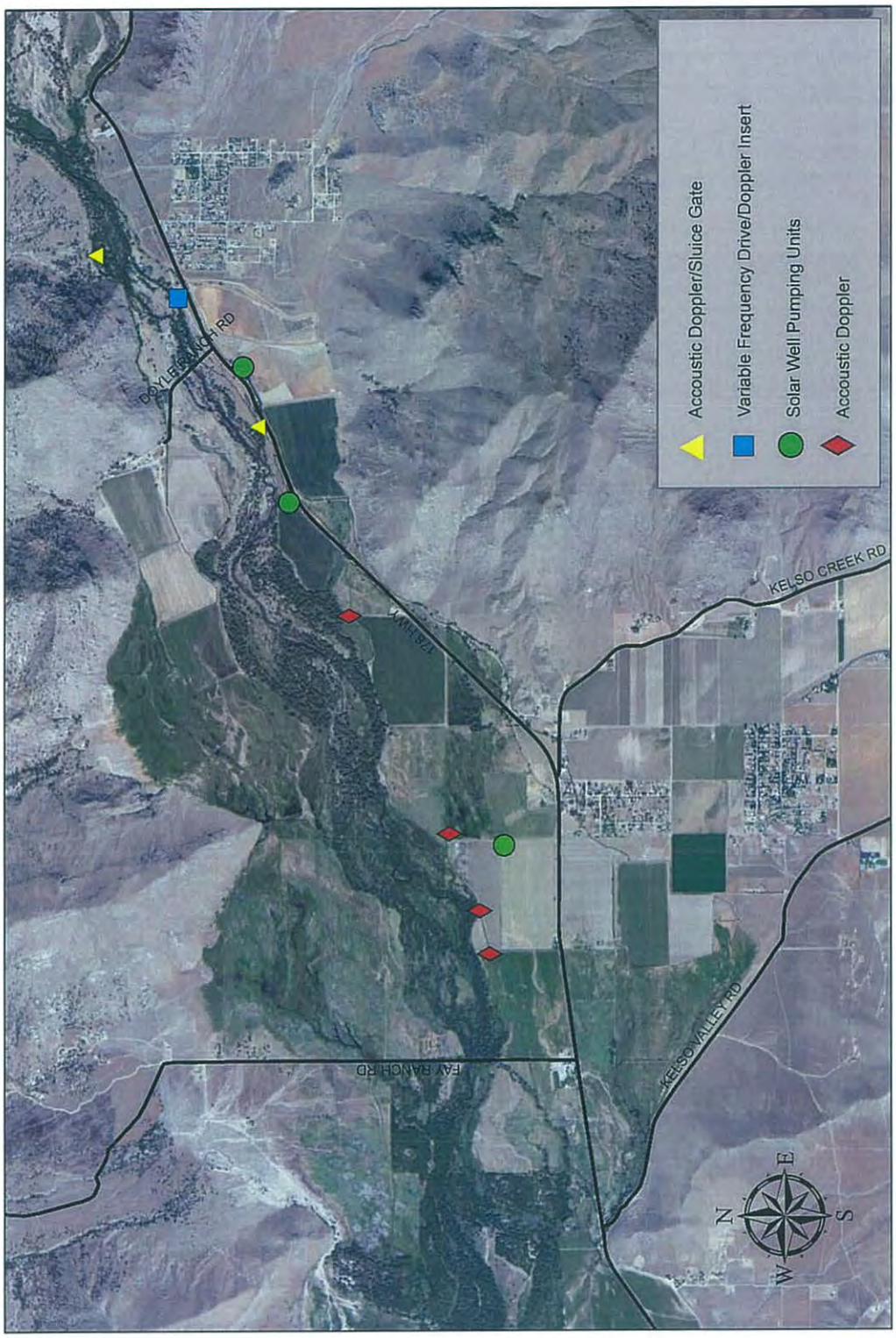


Figure 4. Onyx Ranch Project Component Locations

1.4 Evaluation Criteria/Performance Measures

The Project proposes to better manage approximately **44,000 AFY** and conserve approximately **2,867 AFY** by means of improved system efficiencies by a very comprehensive number of District system improvements including: a canal liner, system metering and control retrofits, and variable frequency drive pump conversions.

1.4.1 Water Conservation – *Evaluation Criterion A*

Quantifiable Water Savings - ***Subcriterion No. A.1(a)***
RRBWSD's average annual water supply (1993-2013) from all sources (Kern River, SWP, CVP, Purchased banked groundwater, Exchanges, Safe Yield, and Precipitation) is about 108,000 AFY. Because the District operates functionally as a groundwater replenishment district all sources are counted. Of these supplies approximately 84,000 AFY goes to crop use, 8,000 AFY goes to urban uses, 6,500 AFY to transfers, 4,000 AFY to recharge and migration losses. Conserved water will help meet dry-year water transfer and exchange programs.

Onyx Ranch's average annual water supply is 24,000 AFY from the South Fork of the Kern River. This reflects the average diversion reflected on the Statements of Diversion as filed with the State Water Resources Control Board for 2009-2012 by the previous owner. This goes to irrigate approximately 1,700 acres of crops and pastures, groundwater recharge, conveyance losses, and return flows to the river itself and other ditch systems. According to previous owner records an average of approximately 5,000 AFY was spilled back into various ditch and river systems. Conserved water will go to increase in-stream flows and potential water transfer programs.

West Intake Canal Lining – RRBWSD currently delivers on average about 20,000 AFY via its West Intake Canal to and from its groundwater banking and recovery project and the Cross Valley Canal, Friant-Kern Canal, and the California Aqueduct. Conveyance losses during recovery periods are about 800 AF which are projected to occur in 1/3 of the years. The total flow through this facility during a recovery cycle is approximately 20,000 AF. By installing a poly liner in the one mile section, as shown in Appendix D, system conveyance losses will be reduced by an average of **267 AFY** which will reduce groundwater pumping, effectively provide more dry-year supply, and reduce energy consumption. This facility is projected to be used for dry-year return in 1 of 3 years for 200 days. It is in dry-year return operations when the seepage loss reduction will be most helpful. By comparing inflow and outflow metering (propeller and acoustic) it has been determined that its average daily seepage losses are typically about 2 cfs which is to be expected based on soil types and recharge rates of nearby recharge ponds. The District proposes to install a 40 mil poly liner as shown in photographs contained in Appendix D. Loss reduction will be easily verified by calculating differences in the existing metering system.

Onyx Control Structure Meter and Flow Retrofits – Historically operators have delivered an average of 24,000 AFY to lands at Onyx Ranch and additional flows to adjacent landowners. Upon acquisition of the property the District has evaluated the existing control and metering infrastructure and desires to make improvements that will drastically improve system operations and reduce system spills, thus returning water to in-stream flows on the South Fork of the Kern River. This will also aid the District and other water-users in compliance with new State Water Resources Control Board and California state law water measurement requirements. This project involves retrofitting of up to nine control structures with a combination of sluice gates and doppler/acoustic flow metering devices. Currently the District uses the existing metering protocol which is a hand held MACE unit which is used to make daily readings that are then assumed to be the mean daily's. The system operator only has access to velocity data since the orifice area calculations are done off-site. By making the recommended improvements as shown in Appendix E, system over diversion and spillage could be reduced by **2,000 AFY** which would return to in-stream flows, used for a transfer program, irrigation deliveries, or used to recharge the groundwater basin. On-farm irrigation efficiencies may also see improvement from improved system measurement and control. Current diversion structures do not have continuous metering equipment and flow control is also quite limited. The Irrigation Training Research Center has evaluated the current system and believes that we could reduce diversions by as much as 50% with better control and metering equipment. Once the retrofitted system is in place we will perform field verification of the flow meters annually to ensure improved accuracy and monitor system spills to evaluate if spill reduction is occurring.

Variable Frequency Drive Units – RRBWSD has identified the potential benefit of retrofitting one existing pumping plant (150 HP) with a variable frequency drives (VFD's). See Appendices E and F. The Mack Pumping Plant, located at the Onyx Ranch, lifts water 30 feet from the Nicoll Ditch up to the Mack Ditch. There are two vertical turbine, single stage pumps, each 150 HP. Each is capable of producing about 26 cfs, for a total of 52 cfs. Most of the time the irrigation demand is not in 26 cfs increments therefore as much as 17% of the produced flow is simply spilled back into the river or meadows after being pumped. This pumping plant delivers an average of 3,600 AFY, by reducing unnecessary pumping system over diversion and spillage could be reduced by an average of **600 AFY** which would return to in-stream flows, used for a transfer program, or used to recharge the groundwater basin (as estimated by the Irrigation Training Research Center). By comparing future and past flow records we will be able to evaluating how much spill reduction is occurring.

Improved Water Management - *Subcriterion No. A.1(b)*

Estimated Amount of Water Better Managed
Average Annual Water Supply

44,000 AFY

108,000 AFY + 24,000 AFY

= 33%

Percentage of Total Supply - ***Subcriterion No. A.2***

Estimated Amount of Water Conserved
Average Annual Water Supply

2,867 AFY
108,000 AFY + 24,000 AFY

= 2.2%

Reasonableness of Costs – ***Subcriterion No. A.3***
As noted later in Section 6.0, the estimated total project cost is $706,573 (without NRCS portion) and is expected to have a life expectancy of 20 years. Life expectancy is based on project design criteria. Using the suggested formula to calculate the "reasonableness of the cost for the benefits gained" this project generates a value of $9.47/AF/year.

Total Project Cost
Acre-Feet Conserved or Better Managed x Improvement Life

$706,573
2,867 AF x 20 years

= $12.32/AFY

1.4.2 Energy-Water Nexus – *Evaluation Criterion B*

The Project proposes to generate and/or save **285,500 kWh or $42,825** each year by means of improved system efficiencies by a very comprehensive number of District system improvements including: a canal liner, District system metering and control retrofits, and variable frequency drive pump conversions.

Implementing Renewable Energy Projects Related to Water Management and Delivery - ***Subcriterion No. B.1***
Solar Well Pumping Units – RRBWSD contracts with local ranchers to both maintain its groundwater recharge ponds and the Onyx Ranch. At times there is insufficient surface water for stock water purposes therefore the ranchers access large irrigation wells to fill water troughs or even truck water from off-site. By installing inexpensive solar powered pumping units in active irrigation wells these costs and inefficient energy usage can be

avoided altogether. See Appendix G. It is expected that at each site 2 (maybe 3) solar units (2-85 watt panels each) would be used 3-6 months each year to provide stock water when large 100-150 HP wells would otherwise be required. By acquiring these solar units we expect to produce upwards of 1,000,000 gallons per year by generating approximately **300 kWh** each year. While this represents an annual electrical savings of only about $50, more importantly it will also reduce miles driven by water trucks (and labor) that currently move water to the site. This component would eliminate 200 five (5) mile truck trips each year. This provides a combined energy, vehicle, and labor savings of **$6,800 each year**.

Increasing Energy Efficiency in Water Management - ***Subcriterion No. B.2***
Variable Frequency Drive Units – RRBWSD has identified the potential benefit of retrofitting three existing wells (300 HP each) and one existing pumping plant (150 HP) with variable frequency drives (VFD's). With the incorporation of VFD's we would reduce our annual energy usage at this site by at least **179,000 kWh or $26,850** each year. See Appendices E and F.

Wells - The three wells are located within the Enns groundwater recharge area which experiences static depths to groundwater, which vary from as much as 50-250 feet below ground surface, as such the pumping efficiencies vary greatly (68-83%) because of the wide range of operating conditions. These wells were designed as high capacity banking return wells but are also made available to adjacent growers to meet cropping demands. The designed flows are often in excess of the irrigation system capacities thus requiring manually back-pressuring the wells with control valves to reduce flow which needlessly burns valuable head. These wells are capable of providing up to 8,700 AFY with an average usage of about 2,900 AFY at an estimated 450 kWh/AF. With the incorporation of VFD's we will conservatively expect a 7% efficiency improvement which would reduce our annual energy usage by at least **134,000 kWh or $20,100** each year, not counting the back-pressure issue. See Appendix F for technical details.

Pump - The Mack Pumping Plant, located at the Onyx Ranch, lifts water approximately 20-30 feet from the Nicoll Ditch up to the Mack Ditch. There are two vertical turbine, single stage pumps, each 150 HP. Each is capable of producing about 26 cfs, for a total of 52 cfs. Most of the time the irrigation demand is not in 26 cfs increments therefore as much as 17% of the produced flow is simply spilled back into the river or lower meadows after being pumped. Considering that the pumps lift an average of 3,600 AFY it is quite possible that 600 AFY is needlessly boosted at a rate of 52 kWh/AF. With the incorporation of a VFD we would reduce our annual energy usage at this site by at least **31,200 kWh or $4,680** each year. See Appendix E for technical details.

West Intake Canal Lining – By installing a poly liner in the one mile section, as shown in Appendix D, system conveyance losses will be reduced by an average of **267 AFY** which will reduce groundwater pumping by adding additional pumping capacity. Not including the necessary capital infrastructure the expected annual energy savings would be 267 AFY at an estimated 450 kWh/AF or **120,000 kWh or $18,000** each year.

1.4.3 Benefits to Endangered Species – *Evaluation Criterion C*

Water conservation project improvements located at the Onyx Ranch will result in increased in-stream flows which benefit the riparian corridor of the South Fork of the Kern River. This corridor is designated as critical habitat to the Southwestern Willow Flycatcher. Any improvements to the population of Flycatchers also benefits the operations of Isabella Reservoir which at times impacts said species by flood year operations.

1.4.4 Water Marketing – *Evaluation Criterion D*

The District has developed and enjoys partnerships with many different state, federal, and local entities to help improve water management and meet future water demand needs. The District participates in a number of water transfer, banking and exchange programs. These contract relationships vary from 1-30 year programs and offer supplies for urban and agricultural uses. A portion of conserved water from this program could result in increased supplies or flexibility for these and new programs. Currently and historically RRBWSD has worked with the U.S. Department of the Interior, Bureau of Reclamation (USBR) and Fish and Wildlife Service to provide water to the Kern National Wildlife Refuge (KNWR) to the north of the District and to obtain water from the Central Valley Project. RRBWSD also partners with multiple Federal Friant-Kern water agencies for mutually beneficial recharge and recovery projects, namely: Arvin-Edison WSD, Kern-Tulare WD, and Delano ID. It also has banking and transfer projects with Buena Vista WSD, Coachella Valley WD, Irvine Ranch WD, and Castaic Lake Water Agency.

1.4.5 Other Contributions to Water Supply Sustainability – *Evaluation Criterion E*

The Project is not yet within a WaterSMART Basin Study area. Considering the water supply challenges that our basin faces the District has been advocating such a process and leading an effort to employ one. Many of the aspects of this project would undoubtedly be components of improved water management that a study would promote. Currently about a dozen of the local groundwater district are discussing and funding a water basin-wide management plan process (Kern Groundwater Management Committee) to deal with sensitive common concerns such as basin overdraft, increased litigation, reduced imported SWP and CVP supplies, effects of climate change, and increased competition for groundwater. Any water conservation project that is employed, as we have described, would result in reduced dependence on groundwater and reduce overdraft concerns and impacts. The District believes that not only is water supply development a key to a sustainable future water supply but so is water conservation, hence the development of this critical project. The District firmly believes as it employs and promotes its water and energy conservation projects it landowners may also follow suit and has been developing its own strategic plan and wants to promote itself as a leader in the water management industry and likewise lead its water users and others to a more sustainable water management plan. As part of that process, the District has identified project

developments. The water and energy-use efficiency has key components and has identified the above mentioned project components as well as the On-Farm Irrigation Improvement component as key to providing our customers with a sustainable water supply.

On-Farm Irrigation Improvements – In addition to chronic water supply shortages from the State Water Project, which is a key supplemental source for the local groundwater basin, the growing waste discharge regulations instituted by the Regional Water Quality Control Board – Central Valley is driving the District growers towards considering additional irrigation systems improvements in order to reduce over-irrigation and the leaching of nutrients and pesticides to groundwater. To that end the District will cooperate with the Natural Resources Conservation Service (NRCS) to facilitate and promote on-farm cost-share programs and projects that will better manage irrigation water and reduce deep percolation. The District would produce and send out information packages, add information to its website, and host meetings with the landowners. Program goals and objectives will be jointly developed with the NRCS and RRBWSD. Once these goals and objectives are finalized the NRCS will evaluate and facilitate cost-share agreements with the water-users and ensure that the proposed on-farm improvements are consistent with the goals and objectives. Based on communications with growers the District estimates that up to 2,000-5,000 acres of irrigation land within the District (5-10%) would enroll in such a program. Specific improvements could include irrigation system evaluations, tailwater return systems, micro-irrigation systems, pipelines, center pivots, gated pipe, hand move sprinklers, etc.

1.4.6 Implementation and Results – *Evaluation Criterion F*

Project Planning - ***Subcriterion No. F.1***

The District has provided much leadership on a number of basin planning efforts geared towards a more holistic water management strategy. Those include the Kern Groundwater Management Committee, Kern Fan Monitoring Committee, Semitropic Banking Project Committee, Kern Integrated Regional Water Management Plan, and the Kern River Watershed Coalition Authority. The projects described in this application reflect consistence with the goals and objectives of many of the above mentioned initiatives. Other than our own internal planning efforts this project is also consistent with the goals and objectives of many state and local planning efforts such as: the California Water Plan, SBX7-7, Association of California Water Agencies, and the Ag Water Management Council.

In the summer of 2013, upon the acquisition of the Onyx Ranch and the initial operation of the Enns Ponds recovery wells, the District began evaluating water and energy conservation projects that would; a) reduce costs by reducing energy consumption and; b) utilize dry-year supplies more effectively. As part of that effort the District worked through its newly hired District Engineer, consulting Engineering firms, and the Irrigation Training Research Center to identify and provide preliminary design of the projects contained herein. Because the various components are small in nature, detailed

plans and specifications are not necessary since the improvements can be made with off-the-shelf proven technology utilizing District staff and equipment and, to a small extent, an electrical contractor.

The Water Conservation, Energy Efficiency Project, and Solar Power Project has many aspects and details that required early planning, preliminary designs and practical project development. The District has spent significant time and resources evaluating the feasibility of the projects. The evaluation included consideration of issues such as water system delivery effectiveness, construction reasonableness, environmental impacts and cost benefits. In order to further evaluate the project effectiveness and impacts the District continued its efforts to develop these project components and took steps necessary to prepare for project implementation. Below is a list of work performed or efforts put forth to support project development:

District Engineer, Technical Memo – Appendix D
West Intake Canal Liner

Engineer Consultant - ITRC, Technical Memo – Appendix E
Flow Measurement and Infrastructure Recommendations, Onyx Ranch

District Engineer, Technical Memo – Appendix F
Enns Wells VFD Retrofit

District Engineer, Technical Memo – Appendix G
Solar Pump Units

Readiness to Proceed - ***Subcriterion No. F.2***
With funding assistance from the Bureau of Reclamation and the Natural Resources Conservation Services (NRCS), in connection with a 2014 WaterSMART Grant, the District will proceed with implementing the proposed project according to the estimated schedule. Please see Appendix C for schedule.

In general, it is the intention of the District to satisfy all CEQA and NEPA compliance requirements prior to any project groundbreaking activities of project components proposed under the project. Continued project planning, designs and procurement will be performed concurrently with the CEQA and NEPA process when best suited for planning efficiency. Wherever possible, and as the schedule will allow, project component tasks are staggered to make the best use of time but as with all large projects efficient planning is required and therefore parallel efforts and overlap are unavoidable. Once the project is CEQA and NEPA compliant the construction activities for components to include ground disturbing activities will begin. Additionally, project activity will have to be coordinated with normal District operations.

The District has contacted the local NRCS office as part of the application process to this grant. We have reviewed AWEP and EQIP programs and expect the on-farm aspects of

this project to fully compliment NRCS efforts. If the grant is awarded to the District we will continue the cooperative effort to establish joint goals and objectives that both the NRCS and the District would support as part of this project.

It is estimated that the design and procurement will begin in May 2014, construction and/or ground disturbing activities will begin September 2014 when environmental analysis is complete and that all projects components will be completed by May 31, 2015.

Please see Appendix C for a preliminary project schedule.

Performance Measures - ***Subcriterion No. F.3***

While it is extremely difficult to quantify the project's overall improvements to conservation and efficiency we do know that the project components are proven, practical, and effective methods of doing so. That being said, given institutional operational experience, conservative estimates, and the magnitude of the project, we anticipate project improvements to yield approximately: 267 AFY in reduced District system seepage losses, 2,600 AFY in reduced system spills, 250 kWh of solar energy production, and 285,250 kWh is reduced energy consumption.

After completion of the project, performance measures will be employed to help quantify actual project benefits:

Seepage Losses

Project components that improve or eliminate seepage losses will compare pre-project water volume loss data directly to post-project water volume loss data where possible. This performance measure can be directly determined by comparing pre-project and post-project volumetric metering via inflow and outflow testing at multiple times during a given operation and then calculating the pre and post project efficiencies.

System Spills

Project components that reduce system spills will determine performance measures by directly comparing calculated pre-project spill data and post-project spill data within the same delivery system sections. Using appropriate averages, water volume savings can be calculated by subtracting post-project spills from pre-project spills.

Solar Energy Generation and Reduced Trips

Project components that produce solar energy production will determine performance measures by documenting the number of days utilized times the solar generation capacity of the units along with the number of water truck trips reduced.

VFD Reduced Energy Usage
Project components that reduced energy usage will determine performance measures by comparing existing pre-project and post-project efficiency values for the wells via multiple follow-up pump tests on the wells in varying conditions and by documenting revised operations of the Mack Pumps with actual flow demands versus pre-project fixed flow conditions and comparing systems spills.

Benefit Endangered Species and/or Critical Habitat
Project components that reduce system spills and over diversion that result in increased stream flows in the riparian critical habitat will determine performance measures by estimating how much additional flow was available to support the critical habitat as well as record searches for T&E species status in the area.

Benefit to Water Markets
Project components that improve or eliminate seepage losses that could result in an increased water market will compare pre-project water market activity to post-project water market activity.

Over Irrigation
Project components that improve irrigation efficiency associated with a potential NRCS project will determine performance measures by completing irrigation evaluations as performed by the local Mobile Irrigation Lab (operated by the Northwest Kern Conservation District).

1.4.7 Additional Non-Federal Funding – *Evaluation Criterion G*

$$\frac{\text{Non-Federal Funding}}{\text{Total Project Cost}}$$

$$\frac{\$406{,}573}{\$706{,}573}$$

$$= \mathbf{58\%}$$

1.4.8 Connection to Reclamation Project Activities – *Evaluation Criterion H*

(1) How the proposed project is connected to Reclamation project activities? **Increases in District operational efficiencies will in-directly and directly benefit multiple Federal project districts by increasing the District's dry-year supplies that it can return to them via banking and exchange projects and reducing groundwater recovery costs that they pay as part of those projects.**

(2) Does the applicant receive Reclamation project water? **Yes**

(3) Is the project on Reclamation project lands or involving Reclamation facilities? **No these are District lands and facilities.**

(4) Is the project in the same basin as a Reclamation project or activity? ***Yes, the District shares the same Kern groundwater basin with many Federal contract Districts.***

(5) Will the proposed work contribute water to a basin where a Reclamation project is located? ***Yes, the project is located within the Friant-Kern service area.***

2. Environmental Compliance

The Water Conservation, Energy Efficiency, and Solar Power Project is comprised of four project components that are located or will be located at up to 16 different sites. Considering the On-Farm Irrigation Improvements, there could potentially be an additional 10-20 project sites. In general, all potential project sites and associated project activity will be located or conducted on existing facilities, right-of-ways, and lands that are routinely used, operated, and maintained.

The four project components would all occur on existing RRBWSD right-of-ways, lands, and facilities. These facilities include canals, drains, head gates, pumps, and any associated appurtenances which are part of the District's water conveyance system. RRBWSD maintains and operates these facilities on a regular basis to provide a functioning water delivery system to deliver water to water users and its recharge and recovery facilities. Maintenance and operation activities include, but are not limited to, grading canal roads and canal banks, repairing or replacing head gates, silt and vegetation maintenance, pump removal and repairs, ditch tending, vehicle and personnel traffic.

The On-Farm Irrigation Efficiency component would be similar to the environmental conditions described for the above project components but would normally take place on private landowner property. Typical farming operations include, but are not limited to, tilling, disking, grading, pests and weed control, planting, harvesting, farm equipment and personnel travel.

RRBWSD will conduct an Initial Study according to the regulations and guidelines of the California Environmental Quality Act (CEQA) and proceed as required for CEQA compliance. Additionally, National Environmental Policy Act (NEPA) compliance will be required if Federal funds are applied to the project. RRBWSD will assist and support the Bureau of Reclamation in the NEPA compliance process as necessary.

2.1 Impacts to Surrounding Environment

The majority of proposed project components will require limited earth-disturbing activities. When considering the potential surface area to be disturbed, the West Intake Canal Lining Project would be the single project component that would disturb the most surface area. This would require grading approximately one mile of the canal to prepare for the installation of the polymer liner along with removal of unwanted debris and vegetation. This currently occurs as part of our regular maintenance schedule so it is expected to be a very limited impact. Other components of this project would require minimal excavation to retrofit structures and underground pipes which would typically range from 3 to 8 feet deep between 10 to 25 linear feet. Other examples of minimal disturbances would include installing small concrete pads for VFD's, Solar Pumps, and control panels and the digging of trenches for electrical conduit lines.

RRBWSD as well as local contractors have extensive experience with excavating activities and utilize best management practices concerning dust and erosion control. RRBWSD or the contractor would access a water truck or portable pumps for necessary dust suppression. Dust impacts to the environment will be minimal but will be evaluated according to CEQA and NEPA requirements.

All earth disturbing activities will be done absent of local irrigation or drain water in the canals or drains. Disturbed earth will have no contact with flowing water and therefore will have no impact to irrigation supply water or drain water. Project activities would not occur on natural stream or river channels. There will be no impacts to water but the potential impacts will be evaluated according to CEQA and NEPA requirements.

All project activities will occur on routinely disturbed ground and therefore will have minimal or no impact to animal habitat. The presence of working facilities along with routine RRBWSD and farmer activities make it unlikely for animals to use project sites as habitat. Potential impacts to animal habitat will be evaluated according to CEQA and NEPA requirements. Any necessary biological or cultural surveys will be conducted by qualified personnel as required for CEQA and NEPA compliance.

2.2 Endangered or Threatened Species

Although all project activities are going to be conducted on land that is routinely disturbed by irrigation and farming operations. Kern County is known to have habitat that can support endangered and threaten species. Listed below are several species that were listed on the CNDDB Records nearby the project sites. This list below is only intended to provide a list of potential endangered or threaten species in the general region of RRBWSD. By the limited nature of the construction the District does not expect to have any impact on any of these species or corresponding suitable habitat within the project sites.

1. San Joaquin Antelope Squirrel – CT
2. Tipton Kangaroo Rat – FE, CE
3. Blunt-nosed Leopard Lizard – FE, CE
4. San Joaquin Kit Fox – FE, CT
5. Western Burrowing Owl – CSC
6. Tricolored Blackbird – CSC
7. Southwestern Willow Flycatcher – FE, CE

(FE – Federally Endangered, FT – Federally Threatened, CE – California Endangered, CT – California Threatened, CSC – California Species of Special Concern)

Potential impacts to Endangered or Threatened Species will be evaluated according to CEQA and NEPA requirements.

2.3 Wetlands

According to the U.S. Fish and Wildlife Service National Wetlands Inventory there are no wetlands within project boundaries. There are however wetlands indicated in the nearby vicinity of some of these project sites but are not expected to be negatively impacted by this project due to the limited nature of the ground disturbance.

2.4 Water Delivery System

RRBWSD operates a surface water delivery system with more than 25 miles of earthen canals. The water delivery system was developed in the late 1800's up to the 1970's. Many of the canal alignments have been realigned or modified over that time. Also, almost all of the check and gate structures have been replaced or updated over the same period in order to maintain a working water delivery system.

2.5 Modification to System Features

The West Intake Canal in entirety is a two mile canal with a one mile section of earthen canal and a one mile section that is concrete lined. The earthen section would be graded and lined with a polymer liner. This does not alter the function or location of the canal but would alter the maintenance activities in the lined section. The canal is part of the water delivery system that was developed in the late 1970's. There will be no impact to the alignment or size of the canal.

The VFD units will be installed alongside existing electrical control, meter, and transformer sites for three groundwater wells and one pump stations. All of these units were constructed in the past 5 years. There will be no impact to the normal operations of the facilities, only improved flow control and operational efficiency.

The Solar Pump units will be installed on existing agricultural wells no longer used due to groundwater production issues. While the old agricultural wells no longer produce flows sufficient for irrigated agriculture they do have sufficient capacity to serve as source supply for low flow livestock watering systems. Small submersibles will be installed along with a solar panels for pumping stick water into nearby troughs. There will be no impact to the operations of these wells because they are currently unused.

The flow metering and control retrofits will take place on 9 existing sites. Minimal site disturbance is required for the installation of sluice gates and acoustic/doppler meters at each site.

In regards to the On-Farm Irrigation Improvements, RRBWSD has no records of on-farm irrigation systems or their details and cannot provide an estimate of when those existing systems were constructed.

2.6 National Register of Historic Places

There are no registered historical landmarks within the project boundaries. RRBWSD does not have any knowledge of any other items that are listed or may be eligible for listing under the National Register of Historic Places.

2.7 Archeological Sites

RRBWSD does not have any knowledge of known archeological sites within or in the vicinity of the proposed project sites. There has been over a century of ongoing farming operations and it is very unlikely that archaeological sites would be currently located or discovered within district boundaries. Potential impacts to cultural resources will be evaluated according to CEQA and NEPA requirements.

3. Required Permits or Approvals

Due to the nature and location of selected project sites we expect that no third party approval or permits will be required from local, state, or federal agencies in order to break ground for the Project.

4. Funding Plan and Letters of Commitment

At this time, RRBWSD is solely responsible for the funding of the Project. RRBWSD will continue to consider other agency collaborators to participate in the Project.

The estimated cost of the project including, feasibility study, environmental assessments, all associated construction cost, CEQA documents and permits is $706,573. Please refer to Table 2 in Section 6.0, Budget Proposal for detailed estimated cost.

RRBWSD is requesting approximately **$300,000** in federal funding (USBR and NRCS). The Project will directly conserve water and energy beyond twenty years and RRBWSD is estimated to provide 58% of project funding if the requested award amount is granted.

Currently there is no other funding request submitted or funding applications pending approval. The Project is a substantial construction project where Reclamation funding would increase the likelihood of successful project completion and continue a RRBWSD and USDIBR partnership. The Project directly makes available a quantifiable amount of additional water that can be used to meet increasing water demand. Although federal assistance is requested, if USDIBR declined to participate in the Project, RRBWSD would continue to seek other funding opportunities to move forward and attempt to complete the Project.

5. Official Resolution

The Rosedale-Rio Bravo Water Storage District Board of Directors approved Resolution No. 451 on January 14th, 2014.

(Copy)

RESOLUTION NO. 451

RESOLUTION OF THE BOARD OF DIRECTORS OF THE ROSEDALE-RIO BRAVO WATER STORAGE DISTRICT WATER SMART GRANT APPLICATION

WHERAS, Rosedale-Rio Bravo Water Storage District has prepared an application to apply for federal funding from the United States Department of the Interior, Bureau of Reclamation (Reclamation) to assist in the funding of the Water and Energy Efficiency Project; and

WHERAS, the funding opportunity provided by Reclamation through their Grant Program entitled "2014 WaterSMART: Water and Energy Efficiency Grants for FY 2014" Funding Opportunity Announcement No. is #R14AS00001; and

WHERAS, the Water Conservation, Energy Efficiency, and Solar Power Project involves installing canal lining, volumetric measurement and control improvements, solar groundwater pumping units, and variable frequency drive systems to improve overall system efficiency by reducing: groundwater pumping, canal seepage, energy consumption, and over-diversion which will reduce operational costs and make available additional water for multiple beneficial uses; and

THEREFORE, BE IT RESOLVED, the Rosedale-Rio Bravo Water Storage District Board of Directors have reviewed the application and support its submittal for Reclamation assisted funding. The Board of Directors approve Dan Bartel, Assistant General Manager-Engineer, as the official with legal authority to enter into a cooperative agreement with Reclamation and confirm that Rosedale-Rio Bravo Water Storage District is capable of providing the amount of funding specified in the application. Rosedale-Rio Bravo Water Storage District will work with Reclamation to meet established deadlines for entering into a cooperative agreement.

PASSED APPROVED AND ADOPTED on this 14 day of January, 20 14 by the following roll-call vote:

AYES: Directors Pierucci, Selvidge, Enns, Unruh & Millwee
NOES: None
ABSENT: None
ABSTAINED: None

ROSEDALE-RIO BRAVO WATER STORAGE DISTRICT

President/Board of Directors

ATTEST:

Secretary/Board of Directors

6. Budget Proposal

The estimated cost of the Water Conservation, Energy Efficiency, and Solar Power Project is $706,573. Please refer to the following table identifying budget items and associated cost.

Table 2. Project Budget

Item		Budget Item Description	$/Unit	Unit	QTY	RRBWSD Funding	Reclamation Funding	Total Cost
1		***Salary & Wages***						**53,800**
	a	Engineering & Project Administration	76.93	HR	100	7,693	0	7,693
	b	Project Support	22.60	HR	150	3,390	0	3,390
	c	Project Management	50.18	HR	150	7,527	0	7,527
	d	District Maintenance Personnel	23.46	HR	1,500	35,190	0	35,190
2		***Fringe Benefits***	*1.52 multiplier*					**106,523**
	a	Engineering & Project Administration	40.00	HR	100	17,669	0	17,669
	b	Project Support	11.75	HR	150	29,618	0	29,618
	c	Project Management	26.09	HR	150	29,618	0	29,618
	d	District Maintenance Personnel	12.20	HR	1500	29,618	0	29,618
3		***Travel***	0		0	0	0	**0**
4		***Construction Equipment***	45	HR	750	33,750	0	**33,750**
5		***Supplies & Materials***						**378,500**
	a	Office Supplies	1500	LS	1	1,500	0	1,500
	b	Vehicle Fuel	4	GA	400	1,680	0	1,600
	c	Diesel Equipment Fuel	4	GA	600	2,424	0	2,400
		West Side Canal Lining Project						
	d	Polymer Liner (4 mil)	0.55	SF	250,000	0	137,500	137,500
		Onyx Flow Control & Metering						

	e	Pipe & Fittings	1000	LF	9	9,000	0	9,000
	f	Meters	8000	LS	9	45,000	27,000	72,000
	g	Gates	3000	LS	3	9,000	0	9,000
		VFDs						
	h	150 HP VFD unit	30000	EA	1	10,000	20,000	30,000
	i	300 HP VFD unit	35000	EA	3	0	105,000	105,000
		Solar Well Pumps						
	j	Solar Pump Units	3000	EA	3	0	9,000	9,000
	k	Misc. Materials	500	EA	3	0	1,500	1,500

6		***Contractual / Construction***						**84,000**
	a	Engineering Design	120	HR	200	24,000	0	24,000
	b	VFD Installation	15000	EA	4	60,000	0	60,000

7		***Environmental and Regulatory Compliance***						**50,000**
	a	Project Biological & Cultural Surveys	7500	LS	2	15,000	0	15,000
	b	CEQA & NEPA	35000	LS	1	35,000	0	35,000
	c	E&R percent of total cost						**7%**

8		***Total***						**706,573**
	a	RRBWSD Contribution				**406,573**		
	b	Reclamation Contribution					**300,000**	
	c	Percent Funded by RRBWSD						**57%**

The following is a description of the line items in the above table.

1) Salary & Wages

The wages listed are hourly rates for each listed employee.

a-c) This is the projected hours and the average hourly rate of the Assistant General Manger-Engineer, Operations Manager, Office Manager, and Maintenance II. The task will include project design and management, construction management environmental management, budget and personnel management, reporting, installation, inspection, and testing.

d) This budget line item is the average hourly rate and projected hours for maintenance personnel that will be required to implement project components. They will be required to perform a wide range of duties ranging from heavy equipment operating to manual labor.

2) Fringe Benefits

The fringe benefits are calculated on a monthly basis and have been converted to hourly for the purposes of this application which equates to a multiplier of 1.52. These benefits include medical insurance, dental insurance, vision insurance, life insurance, retirement plan, vacation leave, sick leave, bereavement leave, protective equipment and uniforms, social security, Medicare, and workers compensation.

3) Travel – There are no travel expenses associated with this project.

4) Construction Equipment – RRBWSD currently owns heavy equipment that is sufficient for project implementation or contractor estimates include outside equipment usage. RRBWSD is not projected to purchase equipment for this project.

5) Supplies & Materials

a) This is the estimated cost of typical office materials used in association with this project. This includes, but not limited to administrative materials such a paper, shipping and packaging, copies, photographs, publishing, and binders.

b) This is the estimated cost of the fuel necessary to travel to many different project sites over the course of the project for the above listed employees. Estimates are based on number of employees traveling to and from the sites, ride sharing, and 15 miles per gallon of gasoline.

c) This is the estimated gallons of diesel fuel required to operate RRBWSD heavy equipment for the project at 2 gallons per hour per equipment.

d) This is quoted cost to purchase "20 year life" polymer liner for the West Intake Canal Lining Project.
e) This is the estimated cost for a combination of pipe, fittings, and appurtenances for the meters and flow control structures.
f) This is the estimated cost for new acoustic and doppler meters for each site.
g) This is the estimated cost for the control gates at each applicable site.
h) This is the estimated cost to acquire 150 HP VFD and applicable appurtenances at each site.
i) This is the estimated cost to acquire 300 HP VFD and applicable appurtenances at each site.
j) This is the estimated cost for a combination pump and solar panels for the stock watering systems.
k) This is the estimated cost for appurtenances and security for each solar pump site.

6) **Contractual / Construction** – Work in this section will be done by contractors and consultants.

a) This is the estimated cost for engineering design and specifications for VFD's, canal liner, and flow control and metering.
b) This is the estimated cost for contractor installation of VFD units.

7) **Environmental and Regulatory Compliance**

a) This is the estimated cost to conduct project biological and cultural surveys by qualified consultants as required for CEQA and NEPA compliance.
b) This is the estimated cost to prepare all necessary studies, reports and other documents for the project. This includes cost for environmental consultants.
c) This is the percent of the total project cost that is attributed to environmental and regulatory compliance.

8) **Total** – These are the totals for RRBWSD contribution, Reclamation contribution, and the total estimated cost of the project.

a) This is the proposed total contribution by RRBWSD.
b) This is the proposed total contribution by Reclamation.
c) This is the calculated portion funded by RRBWSD.

APPENDIX A

Rosedale-Rio Bravo Water Storage District

2013 Crop Survey Data

RRBWSD Crop Survey 2013

From KC Permit Data as of August 27, 2013

Crop	Gross Acreage (1) (Acres)	Net Irrigated Acreage (2) (Acres)	Applied Water Requirements (3) Per Acre (AF/Ac.)	Applied Water Requirements (3) Total (AF)	Percent of Total Water Applied	Consumptive Use Requirements (7) Per Acre (AF/Ac.)	Consumptive Use Requirements (7) Total (AF)	Percent of Total Consumptive Use
Cotton	1,920	1,824	3.6	6,566	5.33	2.7	4,925	5.52
Alfalfa	6,158	5,850	5.1	29,841	24.05	3.8	22,230	24.91
Almonds	11,958	11,360	4.1	46,956	38.09	3.1	35,216	39.46
Pistachios	1,948	1,851	4.0	7,402	6.01	3.0	5,552	6.22
Misc. Trees (4)	36	34	4.0	137	0.11	3.0	103	0.11
Grapes	421	400	3.1	1,227	0.99	2.3	920	1.03
Corn (Field & Sweet)	932	885	3.2	2,833	2.30	2.4	2,125	2.38
Potatoes	1,081	1,027	3.7	3,834	3.11	2.8	2,875	3.22
Wheat & Grains	2,518	2,392	1.9	4,465	3.62	1.4	3,349	3.75
Vegetable Crops (5)	1,381	1,312	2.7	3,499	2.84	2.0	2,624	2.94
Pasture & Grass	214	203	5.2	1,057	0.86	3.9	793	0.89
SUBTOTAL	28,567	27,139	4.0	107,616	87.30	3.0	80,712	90.43
Industrial & Residential (6)	7,490	7,116	2.2	15,654	12.70	1.2	8,539	9.57
Fallow & Undeveloped Lands	5,588	5,309				0.4	2,123	
TOTAL	41,645	39,563	3.1	123,270		2.3	91,374	

NOTES:

(1) Gross Acreage represents net assessable acres per the Assessment Roll. Includes irrigated acreage within District owned property in Section 1, 30/25.

(2) Net Irrigated Acreage is assumed to be 95 percent of the Gross Acreage.

(3) Irrigation efficiency assumed to be 75%.

(4) Includes fruit and eucalyptus trees.

(5) Vegetable crops include carrots, beans, sugar beets, tomatoes, onions, broccoli, peppers and garlic.

(6) Includes commercial, industrial, feedlots, dairies, hydrophonic vegetable, oil facilities, residential and schools.

(7) Consumptive Use values based on ITRC methodology & average rainfall of 5.86 in/yr.

Canals & Recharge Basins =	1,258	Ac
Total Net Assessable Area =	42,903	Ac
Total Gross Area of District =	44,380	Ac
Estimated Cons Use of Precip =	13,848	Ac-ft
Cons Use - Cons Use of Precip =	77,526	Ac-Ft

APPENDIX B

Project Summary Matrix

ROSEDALE -RIO BRAVO WATER STORAGE DISTRICT
WATER CONSERVATION, ENERGY EFFICIENCY, AND SOLAR POWER PROJECT
PROJECT EVALUATION MATRIX

Component	Financial						
	Capital Cost	Annual Capital Cost	Increased Annual O&M Cost	Total Annual Cost	Annual Water Savings (AF)	Total Annual Benefit ($)	Benefit/Cost Ratio (3)
West Intake Canal Liner	$ 175,000	$ 12,880	$ -	$ 12,880	267	$ 28,000	2.17
Onyx Flow Control and Metering	$ 134,000	$ 9,862	$ 4,020	$ 13,882	2,000	$ 250,000	18.01
Mack VFD	$ 45,000	$ 3,312	$ 1,000	$ 4,312	600	$ 81,750	18.96
Enns Well VFD's	$ 150,000	$ 11,040	$ 2,000	$ 13,040		$ 20,100	1.54
Solar Well Pump Units	$ 12,000	$ 883	$ 360	$ 1,243		$ 6,800	5.47
	$ 516,000						

Component	Source of Supply							Adjoining Entities Issues						
	Kern River (Surface)	SWP (Surface)	SWP (Exchange)	Tailwater	Kern River (GW)	SWP (GW)	Score (out of 100)	BVWSD	KCWA	KWBA	WKWD	STWSD	PRIVATE	Score (out of 100)
	1	1	1	1	1	1	6	1	1	1	1	1	1	6
West Intake Canal Liner	5	5	5		5	5	42	1	1	1	1	1	3	13
Onyx Flow Control and Metering	5			5	5		25						1	2
Mack VFD	5			5	5		25						1	2
Enns Well VFD's					5	5	17						1	2
Solar Well Pump Units					5		8						1	2

Component	Legal					Environmental Factors							CEQA (2)				
	Water Rights	MOU	Contract Negotiation	Litigation	Score (out of 100)	Water Quality	Water Levels	ESA - Species	ESA - Habitat	Wetlands	Economic Impacts	Score (out of 100)	Categorical Exemption	Negative Declaration	Mitigated Neg. Dec.	Environmental Impact Report	Score (out of 100)
	2	1	2	5	10	1	2	2	1	1	1	8	2	6	7	10	25
West Intake Canal Liner					0	3	3	1	1	1		11		4			24
Onyx Flow Control and Metering	5				5	3	3	3	3	3		19		4			24
Mack VFD	5				5	3	3	3	3	3		19		4			24
Enns Well VFD's					0							0		2			12
Solar Well Pump Units	2				2		3			3		8		2			12

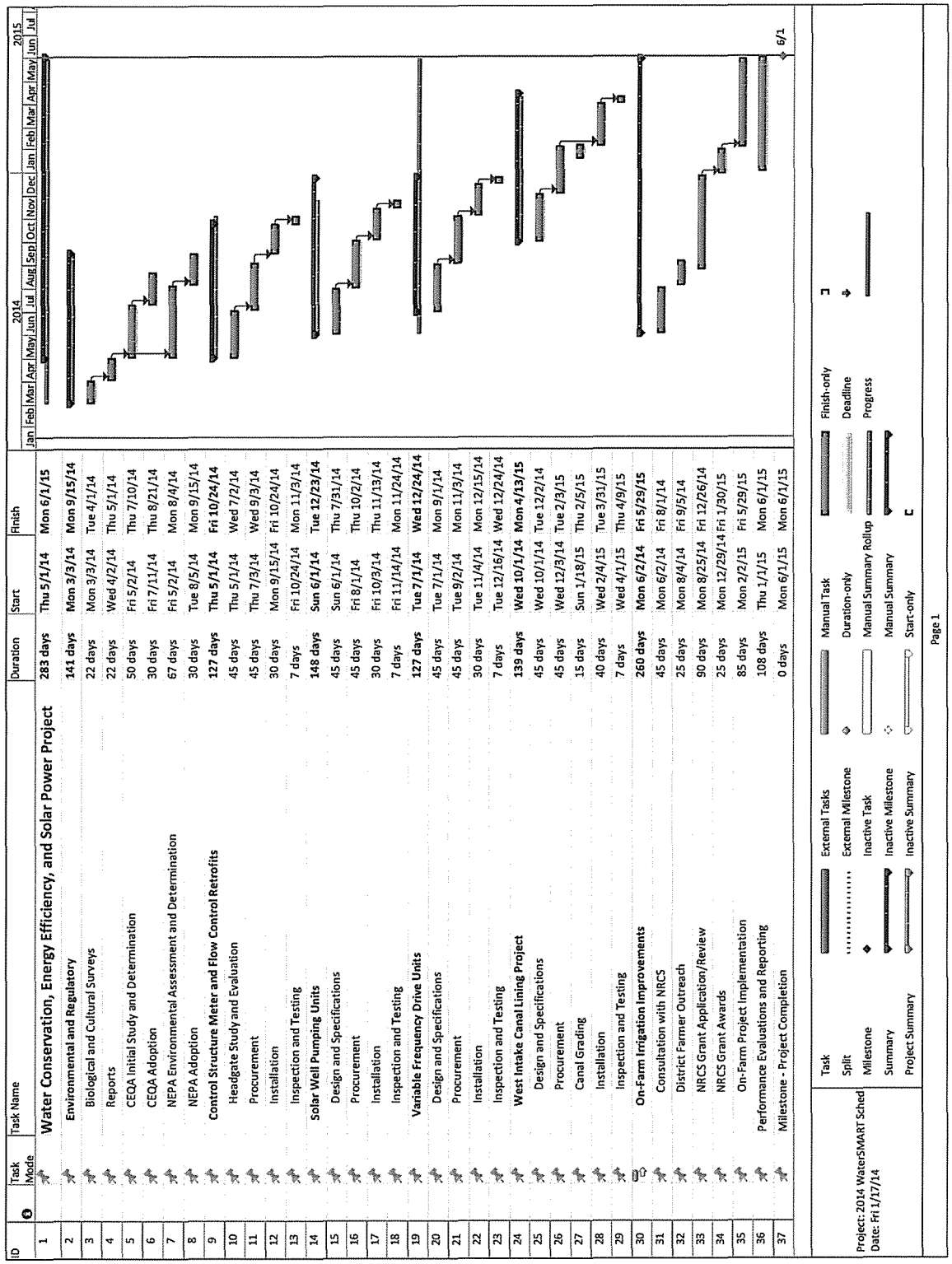
Component	Permitting / Approval												
	USACOE - 404	USFWS	CDFG - 1601	CDFG - Incidental Take	CRWQCB - 401 WQC	SWRCB - Water Rights	CDWR - SWP	CDWR - Dam Safety	KCWA	KC Supervisors	CalTrans	Kern County Road Dept.	Score (out of 100)
	1	1	1	1	1	1	1	1	1	1	1	1	12
West Intake Canal Liner													0
Onyx Flow Control and Metering													0
Mack VFD													0
Enns Well VFD's													0
Solar Well Pump Units													0

Component	Project Development						Overall Score -- Complexity (Out of 1000)	Ranking (Complexity)
	Land Acquisition	Sitework/Design	Conveyance Facilities	Recharge Facilities	Recovery Facilities	Score (out of 100)		
	1	1	1	1	1	5		
West Intake Canal Liner		2	2			8	123	[illegible]
Onyx Flow Control and Metering		2	2			8	103	[illegible]
Mack VFD		2	2			8	103	[illegible]
Enns Well VFD's		2			2	8	48	[illegible]
Solar Well Pump Units		2			2	8	49	[illegible]

1. Scores represent level of effort required on a scale from 1 to 10, with 1 being easy and 10 being nearly impossible. Therefore, the lowest scores are the most likely to succeed and should receive the highest priority. Each category score is out of a possible 100.
2. Scores shown for CEQA represent level of effort for project implemented alone, not in combination with other projects. Final CEQA effort will be aggregate. Each level is multiplied times a difficulty factor
3. If no other tangible benefit assumption water valued at $125/AF for B/C ratio

APPENDIX C

Preliminary Project Schedule


ID
Task Mode
Task Name
Duration
Start
Finish
2014
2015
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul
1 Water Conservation, Energy Efficiency, and Solar Power Project 283 days Thu 5/1/14 Mon 6/1/15
2 Environmental and Regulatory 141 days Mon 3/3/14 Mon 9/15/14
3 Biological and Cultural Surveys 22 days Mon 3/3/14 Tue 4/1/14
4 Reports 22 days Wed 4/2/14 Thu 5/1/14
5 CEQA Initial Study and Determination 50 days Fri 5/2/14 Thu 7/10/14
6 CEQA Adoption 30 days Fri 7/11/14 Thu 8/21/14
7 NEPA Environmental Assessment and Determination 67 days Fri 5/2/14 Mon 8/4/14
8 NEPA Adoption 30 days Tue 8/5/14 Mon 9/15/14
9 Control Structure Meter and Flow Control Retrofits 127 days Thu 5/1/14 Fri 10/24/14
10 Headgate Study and Evaluation 45 days Thu 5/1/14 Wed 7/2/14
11 Procurement 45 days Thu 7/3/14 Wed 9/3/14
12 Installation 30 days Mon 9/15/14 Fri 10/24/14
13 Inspection and Testing 7 days Fri 10/24/14 Mon 11/3/14
14 Solar Well Pumping Units 148 days Sun 6/1/14 Tue 12/23/14
15 Design and Specifications 45 days Sun 6/1/14 Thu 7/31/14
16 Procurement 45 days Fri 8/1/14 Thu 10/2/14
17 Installation 30 days Fri 10/3/14 Thu 11/13/14
18 Inspection and Testing 7 days Fri 11/14/14 Mon 11/24/14
19 Variable Frequency Drive Units 127 days Tue 7/1/14 Wed 12/24/14
20 Design and Specifications 45 days Tue 7/1/14 Mon 9/1/14
21 Procurement 45 days Tue 9/2/14 Mon 11/3/14
22 Installation 30 days Tue 11/4/14 Mon 12/15/14
23 Inspection and Testing 7 days Tue 12/16/14 Wed 12/24/14
24 West Intake Canal Lining Project 139 days Wed 10/1/14 Mon 4/13/15
25 Design and Specifications 45 days Wed 10/1/14 Tue 12/2/14
26 Procurement 45 days Wed 12/3/14 Tue 2/3/15
27 Canal Grading 15 days Sun 1/18/15 Thu 2/5/15
28 Installation 40 days Wed 2/4/15 Tue 3/31/15
29 Inspection and Testing 7 days Wed 4/1/15 Thu 4/9/15
30 On-Farm Irrigation Improvements 260 days Mon 6/2/14 Fri 5/29/15
31 Consultation with NRCS 45 days Mon 6/2/14 Fri 8/1/14
32 District Farmer Outreach 25 days Mon 8/4/14 Fri 9/5/14
33 NRCS Grant Application/Review 90 days Mon 8/25/14 Fri 12/26/14
34 NRCS Grant Awards 25 days Mon 12/29/14 Fri 1/30/15
35 On-Farm Project Implementation 85 days Mon 2/2/15 Fri 5/29/15
36 Performance Evaluations and Reporting 108 days Thu 1/1/15 Mon 6/1/15
37 Milestone - Project Completion 0 days Mon 6/1/15 Mon 6/1/15
6/1
Project: 2014 WaterSMART Sched
Date: Fri 1/17/14
Task
Split
Milestone
Summary
Project Summary
External Tasks
External Milestone
Inactive Task
Inactive Milestone
Inactive Summary
Manual Task
Duration-only
Manual Summary Rollup
Manual Summary
Start-only
Finish-only
Deadline
Progress
Page 1

APPENDIX D

West Intake Canal Lining Technical Information

TO: File

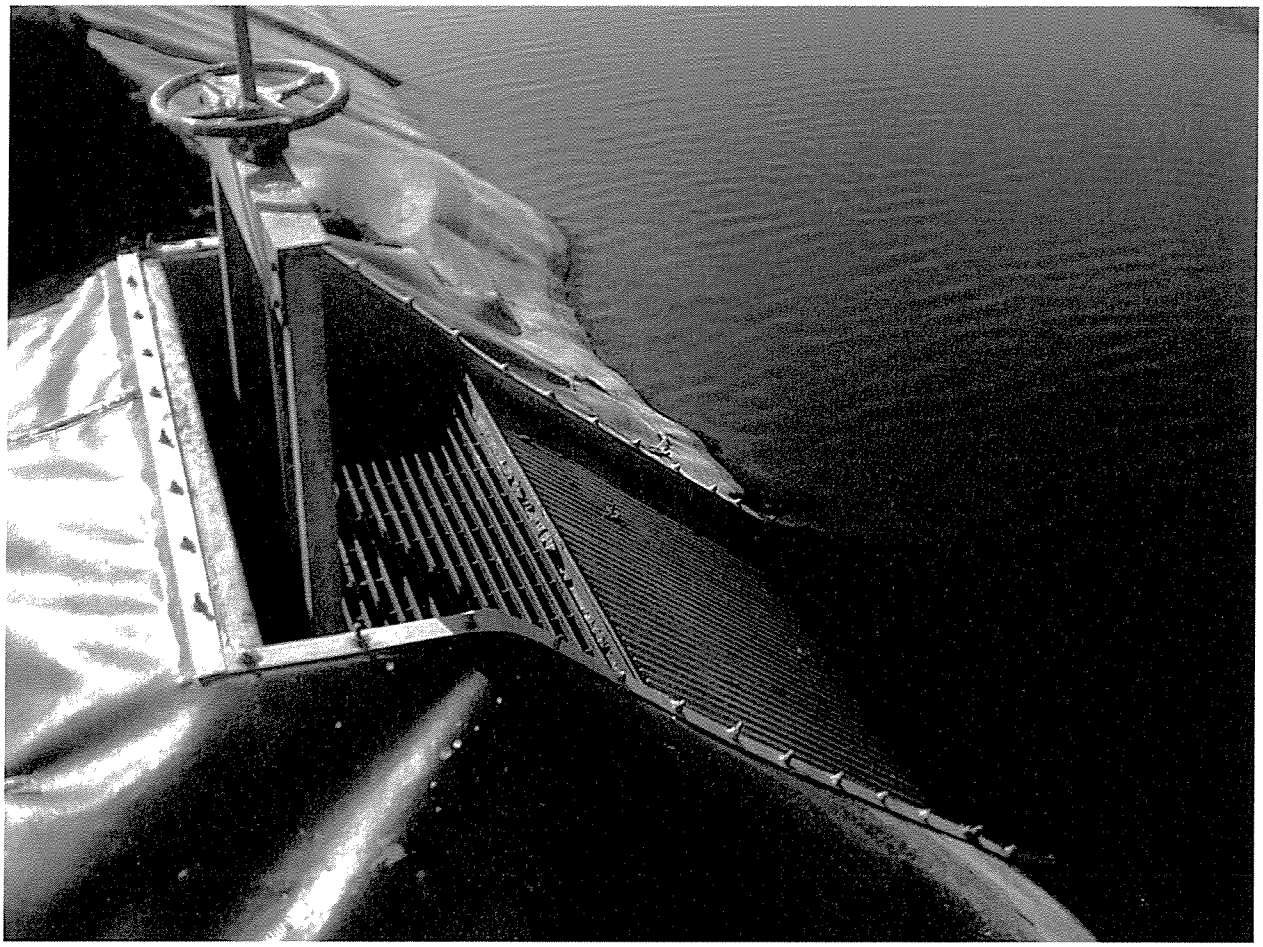
FROM: Dan W. Bartel (CE 56433)

DATE: December 6, 2013

RE: Tech Memo – West Intake Canal Poly Liner

The District has an intake canal that conveys water to and from the Enns recharge and recovery area. It is approximately 1.5 miles long (the southern 0.5 miles concrete lined and the northern 1.0 miles earth lined) and has a capacity of 90 cfs in the northern direction. The unlined section has a top width of approximately 35 feet and the lined section 20 feet. By looking at flow meter differences it appears that the channel has a seepage loss rate of approximately 2 cfs (120 AF/month). When used for recharge operations the loss is of no consequence but during recovery the losses use up precious recovery capacity equivalent to 1/3 of one of the recovery wells. We expect that we will be in recovery mode in 1/3 of the years for approximately 200 days each run. At the current time we have 3 recovery wells but have plans for 5-6 more. This would reflect recovery of 20,000 AF of total flow and 800 AF in 1/3 of the years. This equates to an average of 6,667 AFY better managed and 267 AFY of annual seepage losses.

If a poly liner were installed losses could be reduced, net recovery capacity improved and energy savings realized. It would take a liner of 45' wide by 5,000' long. It is recommended that if the District installs a liner that it use a 4 mil thickness which is extremely durable and could have a life expectancy of 20 years. A 4 mil liner is estimated to cost $0.55/sf and install at $0.15/sf or $175,000 for the entire 5,000 foot by 50 foot reach. The annual capital cost of this project would be $13,000 and M&O costs would be similar to existing. Because there is water conserved there is also the avoided capital costs of 1/3 of a production well of $165,000 ($10,000 annual) as well as avoided energy usage of 120,000 kWh each year or $18,000. This results in a B/C ratio of 2.2 ($28,000/$13,000).



APPENDIX E

ITRC Onyx Ranch Flow Measurement Report

moving water in new directions

IRRIGATION TRAINING & RESEARCH CENTER
BioResource & Agricultural Engr. Dept.
California Polytechnic State University
San Luis Obispo, CA 93407-0730
Phone: (805) 756-2434
FAX: (805) 756-2433
www.itrc.org

Date: January 14, 2014

To: Dan Bartel
RRBWSD

From: Dan Howes, Ph.D, P.E.
Senior Engineer, ITRC
Asst. Prof., BRAE Dept.
Office phone: 805-756-2347
Cell phone: 858-354-0504
djhowes@calpoly.edu

Re: Flow Measurement and Infrastructure Recommendations for Onyx Ranch

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The Irrigation Training & Research Center (ITRC) of California Polytechnic State University, San Luis Obispo, on behalf of Rosedale-Rio Bravo Water Storage District (RRBWSD), was asked to provide recommendations to improve flow measurement within Onyx Ranch. Accurate flow measurement at delivery points to farms and ranches has been mandated for many water users by regulatory agencies in California. The State Water Board requires a Statement of Water Diversions and Use through California Water Code 5101 for users that divert surface water or pump groundwater from a subterranean stream (after 1965). The more recent Senate Bill (SB) x7-7 requires water districts greater than 25,000 acres to report on-farm deliveries of surface water. Regulatory requirements for both the Statement of Water Diversion and Use Program and SB x7-7 have some standards on flow measurement accuracy. Although SB x7-7 has a more defined accuracy standard for this flow measurement.

Flow measurement recommendations summarized in this report were developed to help ensure that RRBWSD could meet these regulatory demands. In addition, the combined infrastructure and flow measurement recommendations will provide the necessary information and control capability to improve operations throughout Onyx Ranch.

The primary objective of these recommendations is to measure and record flow rate continuously (stored every 15 minutes) with good accuracy for the main inflow and return flow to river points on the Onyx Ranch property. With good maintenance and quality construction the recommended flow measurement devices and structures outlined in this report should exceed the accuracy requirements for SB x7-7.

Improved Flow Measurement

The recommendations for the heads of main ditches (Nicoll, Mack, and Landers) are relatively straightforward. There are challenges such as no available head loss, sedimentation, and potential for vandalism. To overcome or minimize these constraints the following recommendations have been provided:

1) Use acoustic Doppler velocity meters that work in partially full and full pipes.
2) Flow displays should be on-site so that the operator has a direct reading of the real-time flow.
3) The system should be powered by a marine gel battery that is manually replaced with a fully charged battery every two to three weeks.
4) The battery, flow display, and cables should be hidden in a buried lock box that is secured on site so that it cannot be seen by passersby.

Similar recommendations are made for key spill sites (termed "B2R" sites, for "Back to River").

Enhanced Operations

There is currently no appropriate flow measurement location directly downstream of the Nicoll and Landers diversion structures from the South Fork of the Kern River. The terrain and vegetation conditions around the head of these ditches would make it difficult to construct a structure and obtain accurate flow measurement readings. Since no fields are served along the upper regions of these ditches, the main control/flow measurement sites should be moved downstream. Each site will be discussed independently in the following paragraphs.

Nicoll Ditch Head
A new undershot/sluice gate should be installed at just downstream of a site referred to as the Nicoll B2R. Flow measurement into Nicoll Ditch will be made using an acoustic Doppler device that should be installed downstream of the existing sluice gate. The Doppler device will be incorporated into a new pipeline that would need to be installed downstream of the sluice gate (installation procedures are discussed in the main report). The new Doppler device will be used operationally to adjust the flow rate into the downstream portion of the Nicoll Ditch downstream of this point. Excess flows in the ditch upstream will pass over an existing weir at the Nicoll B2R, returning to the river. This flow should be measured using an instantaneous measurement device such as the ITRC Weir Stick.

The water level at this site should be monitored (manually) over the B2R weir, maintaining approximately 0.5'over the weir. If the water level is higher or lower adjustments should be made at the diversion structure upstream (at the river). From 2010 to 2012 approximately 37 to

58% of the water passing the current Nicoll Ditch measurement point was spilled through B2R, annually. If operated correctly, as described, the amount of return flow from B2R should be reduced by over 50%. These recommendations will also allow for better control of water throughout Nicoll Ditch which terminates into Leib Ditch and potentially result in spill at the Leib B2R by approximately 25-30%. The spill reduction estimates described above are based on normal to wet water years and are dependent on actual operations.

Landers Ditch Head
A new undershot/sluice gate is recommended at the existing flow measurement site downstream of the Landers diversion from the river at Landers HD MP2. An acoustic Doppler flow measurement device should be installed in the pipeline at the existing site and used for recording and operations. Upstream of this site there is an existing flashboard structure where excess flows return to the river. The water level should be maintained at 0.3 feet above the crest of the weir in order to maintain a constant water level upstream of the new sluice gate. If water levels are higher or lower than this adjustments should be made on the upstream diversion structure (Landers HD). There is currently little spill from the Landers system. Excess flows terminate into a pond in Gibbony Meadows. It is unknown how much water enters this pond annually. Better regulation at the head of Landers will allow the operators to minimize the amount of water entering the pond reducing seepage and evaporation.

Scodie Pump VFD
Currently, the Scodie and Mack Ditches are fed from a pump station along the upper reach of Nicoll Ditch. The pump station consists of two, 150 HP pumps each with a capacity of approximately 20 cfs. A variable frequency drive (VFD) installed on one of the pumps would allow the operators to match supply with demand which is now not possible unless the demand is 20 or 40 cfs. A propeller or insert Doppler meter should be installed in the pipeline between the pump station and the outlet to the Scodie Ditch. The flow meter will allow the operator to adjust the VFD to the appropriate setting to meet demands in the Scodie and Mack Ditches.

The amount of spill from the Scodie/Mack Ditches to the river or other ditches is limited and generally only occurs during periods of heavy rain. During wet years the spill out of the ranch from the Mack system was measured to be 140-250 AF and during dryer years less than 10AF. Excess water at the tailend of the Mack typically terminates into Mack Meadow where it is used by pasture grasses or deep percolates to the groundwater. During 2011, it is estimated that water applied to Mack Meadow was over double of what was used for evapotranspiration (approximately 1,900 AF was applied and 800 AF was used through evapotranspiration).

With proper irrigation management of the Mack Meadow and the new VFD at the head of the ditch it would be reasonable to assume that 500-600 AF of water would not have needed to be diverted from the river to obtain similar evapotranspiration. Combining this amount with an estimated 50AF of spill reduction from the Mack Meadow out of the Ranch, the total reduction in diverted water could be 550-650 AF/Year or higher during normal to wet years.

Comparing electrical records for Scodie Pumping Plant to pumping volumes per month it is estimated that requires approximately 55 kiloWatt-hours are required to pump 1 AF of water.

The addition of the VFD and flow meter along with improved operations could save 30,200-36,800 kWh per year (average electricity rate is approximately $0.2/kWh resulting in an approximate annual cost savings of $6,000 to $7,000). These energy and cost values assume the pump efficiency will not or has not changed and will depend on actual operations and water type year.

Summary and Costs Estimates

The spill reduction estimates described above are based on normal to wet water years and are dependent on actual operations. Recommendations outlined in this report are illustrated in **Figure 1**.

The estimated capital and annual costs for each site in these recommendations are listed in **Table 1**. The estimates include costs for the recommended SonTek IQ Pipe acoustic Doppler velocity meter. A cheaper alternative is the MACE area/velocity flow meter. The MACE device costs approximately half of what the SonTek IQ Pipe costs, but there is more uncertainty in the flow measurements and ITRC's experience with MACE devices has been problematic (conversely, ITRC's experiences with SonTek have been mostly positive). The costs include some installation and maintenance expenses, although a portion of this work is assumed to be included in the O&M for Onyx Ranch.

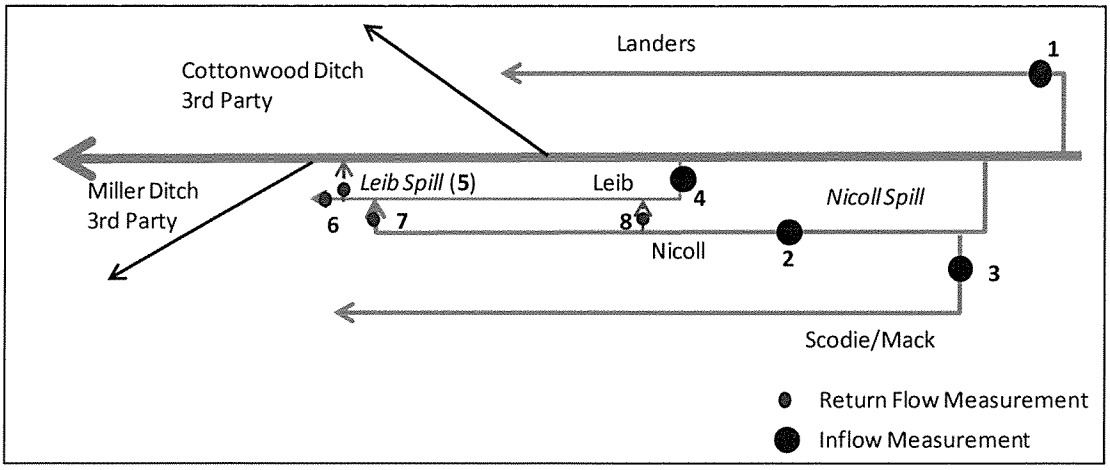


Figure 1. Schematic showing the locations of improvements in Onyx Ranch

Table 1. Estimated cost of improvements at key sites in Onyx Ranch

Site	Modification/Addition	Capital Cost	Annual Cost
Flow Measurement Sites			
1. Landers Ditch MP2	Acoustic Doppler	$13,000	$500
2. Nicoll Ditch d/s of B2R	Acoustic Doppler	$13,000	$500
3. Scodie Pumps	Doppler Insert	$15,000	$500
5. Leib Spill	Acoustic Doppler	$13,000	$500
6. Leib MP1	New Pipeline and Acoustic Doppler	$23,000	$500
7. End of Nicoll Ditch at Leib	Acoustic Doppler	$13,000	$500
8. End of Field Ditch downstream of Boone	Acoustic Doppler	$13,000	$500
Subtotal		***$103,000***	***$3,500***
Infrastructure Improvements			
Landers Ditch MP2	Sluice gate	$12,000	$0
Nicoll Ditch d/s of B2R	Sluice gate and flow measurement pipeline structure	$35,000	$0
Scodie Pumping Plant	VFD, enclosure, AC, installation	$45,000	$1,000**
Subtotal		***$92,000***	***$1,000***
Optional			
Leib Head (optional)	Sluice gate structure and pipeline for flow measurement	$40,000	$0
4. Head of Leib Ditch (optional)*	Acoustic Doppler	$13,000	$500
Subtotal		***$53,000***	***$500***
Total Cost		**$248,000**	**$5,000**

** The cost at the Head of Leib Ditch was included but this is an optional project.*

*** Does not include annual electricity costs. Only includes additional maintenance that may be required due to the VFD. The VFD should be installed in an air conditioned enclosure.*

APPENDIX F

Recovery Well Technical Information

TO: File

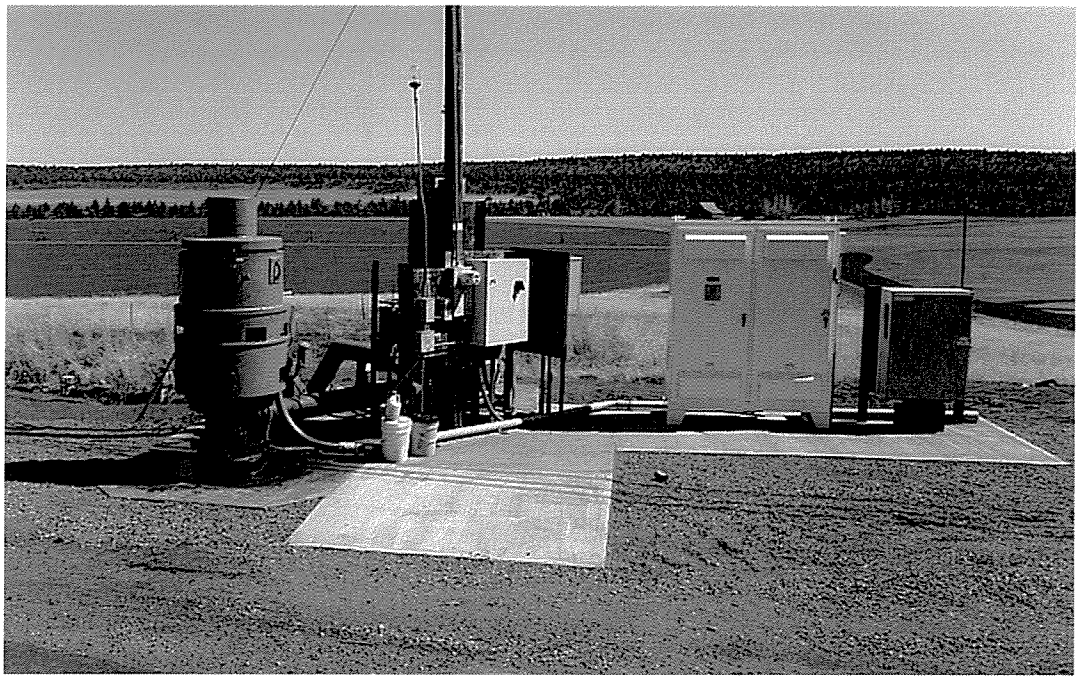
FROM: Dan W. Bartel (CE 56433)

DATE: December 6, 2013

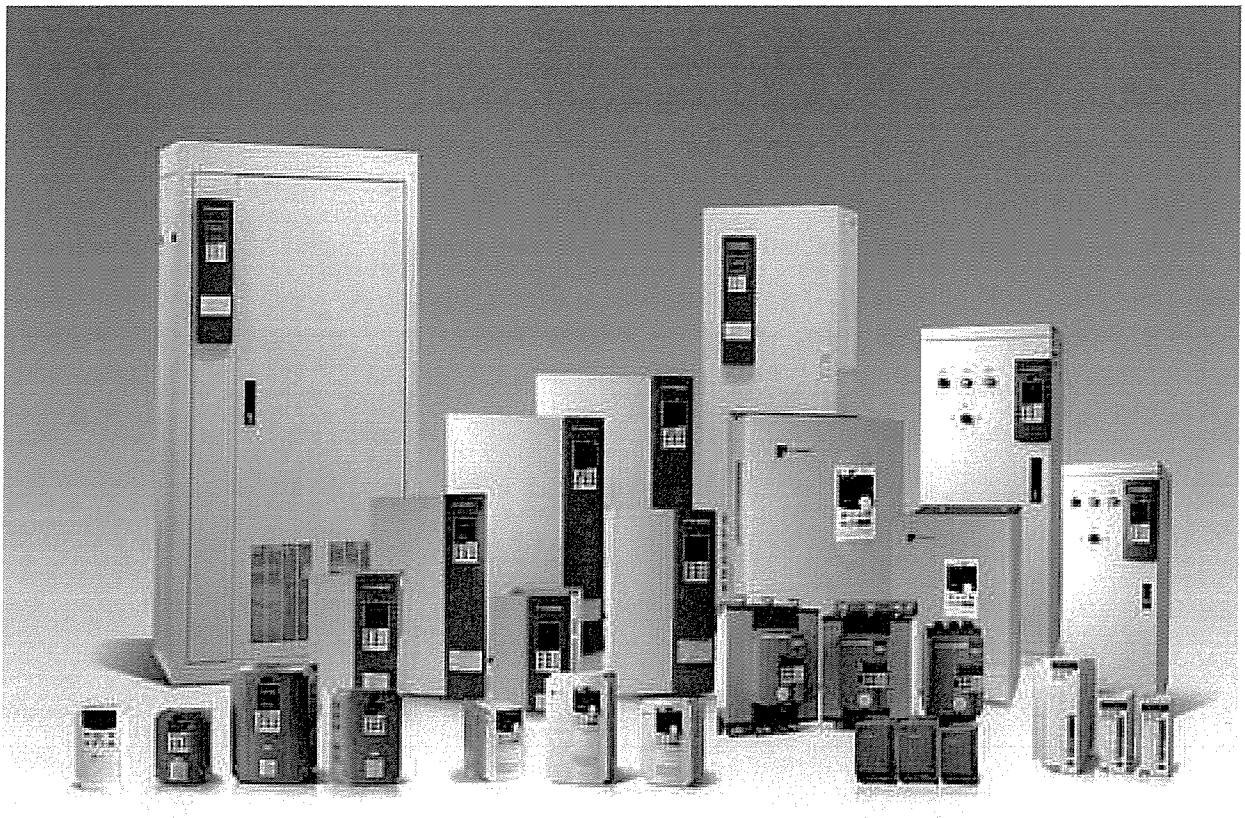
RE: Tech Memo – Enns Wells VFD Retrofit

The District currently operates 3 recovery wells on the Enns project that experience TDH ranges of 100' to 350' bgs with a multistage pump with design points at 3000 gpm at 300'. The pump efficiencies will range from approximately 68-83%. The wells also face conditions where production of less than the design flow is required and surging when water depths are at critically dry levels. At HP's of 150 and above PG&E require a "soft start" system. Given our operating conditions our wells are 300 HP thus either requiring a soft start or, as an option, a VFD (variable frequency drive) system. A VFD would be a preferred option because it is able to vary the speed of the motor so that we could adjust the well to the optimum operating rpm. Instead of burning head when reduced flows are required we could simply slow down the rpm of the motor. Shown on the attached tables and graphs are a simulated operations given the flow tested data from Enns well No. 1. We could vary the motor speed from 1450-1775 rpm and increase our pump efficiency from an operating range of 68-83% range to maintain the optimum 83%, with an average improvement of 7%. Each unit will cost about $50,000 installed, which equates to an annualized cost of $3,700 annual. We expect each well to yield 2,900 AF every three years or 967 AFY for project purposes and each well to well to recover 1,000 AF every three years of 333 AFY for irrigation purposes. The expected average energy savings, for efficiency only purposes, is about $3/AF times the 1,300 AFY or $3,900 per year. We also expect that 25% of time we would be operating in a reduced flow condition of 500 gpm would save an additional $2,800 per year. This is an annual energy savings of 44,666 kWh for each well. If you consider intentionally back pressuring 25% of the time an improved efficiency would result in a B/C ratio of 1.8 ($6,700/$3,700). If you consider only the increased cost of a VFD versus a soft start the ratio is greater - 4.5 ($6,700/$1,500).

Typical RRBWSD Well
300 HP – 3000 gpm @ 300' TDH
Total Depth 475'



Irrigation well fitted with VFD unit to right



VFD units for a range of power applications

APPENDIX G

Solar Well Pump Technical Information

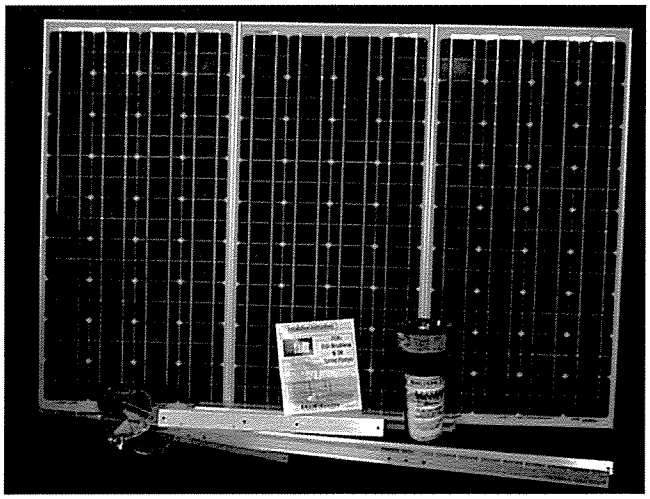
TO: File

FROM: Dan W. Bartel (CE 56433)

DATE: December 6, 2013

RE: Tech Memo – Solar Pump Units

RRBWSD contracts with local ranchers to both maintain its groundwater recharge ponds and the Onyx Ranch. At times there is insufficient surface water for stock water purposes therefore the ranchers access large irrigation wells to fill water troughs or even truck water from off-site. By installing three solar powered pumping units in active irrigation wells these costs and inefficient energy usage can be avoided altogether. It is expected that two solar units (2-85 watt panels each) would be used 3-6 months each year to provide stock water when large 100-150 HP wells would otherwise be required. By acquiring these solar units we expect to produce upwards of 1,000,000 gallons per year by generating approximately 300 kWh each year. While this represents an annual electrical savings of only about $50 more importantly it will also reduce miles driven by water trucks (and labor) that currently move water to the site. This component would eliminate 200 five (5) mile truck trips each year. This provides a combined energy, vehicle, and labor savings of $6,800 each year. Each unit cost about $4,000 installed which equates to an annualized cost of $420 each with M&O. This would result in a B/C ratio of 5.4 ($1260/6,800).



K170 RP2 $2,300.00
2-85 Watt solar panels for a total of 170 watts of power. 25 yr. power output warranty (still producing at least 80% power in 25 yrs)
1-set of aluminum top of pole mounts with fastners. To fit a 2 3/8 OD pole.
1- aluminum submersible dual piston solar pump with 100 ft. of wire attached.
System will produce approximately 1500 gpd max with no lift. Flow decreases as lift and pressure increase. Consult flow chart for an approximate gpm for your well.
Complete installation instructions.
1-sand filter sock included.